

A Clinical Practice Guideline for the Management of Uncomplicated Descending Aortic

Dissection

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A thoracic aortic dissection occurs when a tear or rupture in the layers of the aorta create a true and false lumen which can result in organ malperfusion, paralysis, aortic rupture, and even death (Patel and Arora, 2008). Chest or back pain is the most common presenting symptom of aortic dissection. Patients presenting with complaints of chest pain as well as high risk factors of aortic disease in their past medical history such as aortic aneurysm, a family history of aortic dissection or sudden death, connective tissue disorders, or hypertension, should be evaluated for aortic dissection (Hiratzka, et al., 2010)

Aortic dissections can be classified in various ways: by anatomic location, by acuity, and by the determination of complicated versus uncomplicated dissection. Anatomic classification of aortic dissection can be determined using the Stanford method; type B, or descending dissections, are those involving the aorta distal to the left subclavian artery (Hagan et al., 2000). A review of the International Registry of Acute Aortic Dissection (IRAD) data identified that 37% of patients in the registry who presented with aortic dissection had disease in their descending aorta as opposed to the ascending aorta (Hagan et al., 2000). Hughes (2015) notes that descending aortic dissections account for 25-40% of all dissections.

In addition to anatomical location, dissections also have an acuity classification based on the timing of symptom onset to presentation. The timing of onset was originally classified as: 1) acute, which was designated as under 14 days, or 2) chronic, which was designated as over 14 days from onset of symptoms (Steuer, Bjorck, Mayer, Wanhaien, Pfammatter, & Lachat, 2013).

Recent analysis of survival curves shows that mortality increases substantially in the first 30 days from presentation (Hughes, 2015). Therefore, the aorta is still considered unstable during what is identified as the chronic period by the original classification system. This can significantly impact treatment approaches and patient outcomes (Hughes, 2015). Subsequently, researchers and clinicians have recently identified a subacute phase of dissection to describe the period of time between two weeks and 60 days from the onset of aortic dissection (Steuer, et al., 2013).

Lastly, descending aortic dissections are classified as either complicated or uncomplicated. Complicated dissections account for 15-20% of all descending aortic dissections and occur when the patient exhibits any signs of organ malperfusion, rupture or impending rupture, persistent pain, or refractory hypertension not responsive to medical therapy. Patients with a primary entry tear on the undersurface of the aortic arch are more likely to have complicated dissections on presentation or become complicated during the course of their hospitalization (Hughes, 2015). This finding can be used as a risk stratifier to identify a high risk, complicated dissection (Hughes, 2015). These patients most often receive emergency thoracic endovascular aortic stent repair (TEVAR) while uncomplicated descending aortic dissections are initially managed medically (Hughes, Anderson, & McCann, 2013).

The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) published a clinical practice guideline (CPG) for the management of thoracic aortic disease, including aortic dissection (Hiratzka et al., 2010). The CPG recommendations include initial medical management of uncomplicated descending aortic dissections and consist of risk factor modification, such as smoking cessation and management of hypertension (Hughes et al., 2013; Hiratzka et al., 2010). Hiratzka et al., (2010) identify that smoking has been directly linked to aortic aneurysm and rupture. When blood pressure is optimally controlled, patients with

uncomplicated aortic dissection have a 90% survival-to-hospital-discharge rate and an 80% annual survival rate (Tsai, Trimarchi, & Nienaber, 2009; Nienaber, 2011).

Since the publication of this guideline, new research has revealed improved long term outcomes with endovascular repair and medical therapy, as opposed to medical therapy alone (Nienaber et al., 2013). Current, thoracic endovascular aortic repair (TEVAR) is a mainstay treatment in acute complicated descending aortic dissections to allow for aortic reperfusion, encourage false lumen thrombosis and aortic remodeling, and to prevent late aortic expansion and rupture. The International Registry of Acute Aortic Dissections (IRAD) data reveals a three-year survival of 78% after medical management alone of acute descending aortic dissections. Hughes et al. (2013) note that late aortic related adverse events, most commonly aneurysmal degeneration of the aorta, happen in 25-50% of medically managed descending dissections, and patency of the false lumen is the largest risk factor for an increase in aortic enlargement. Since the encouragement of false lumen thrombosis can lower aortic event rates after descending aortic dissection, some experts are prophylactically treating with TEVAR to prevent late aortic related changes and ultimately improve long term survival (Hughes et al., 2013). However, even with this recommendation and the publication of more recent clinical trials supporting the use of TEVAR in uncomplicated descending aortic dissection patients, there continues to be variability in the management this population. These inconsistencies can lead to miscommunication among the health care team and deviation from standards of care.

The clinical providers of a cardiac surgery service in a large, urban academic medical center frequently cared for patients with uncomplicated descending aortic dissections. These surgeons and nurse practitioners saw a significant need for standardizing the management for these patients to improve patient outcomes and reduce length of hospital stay. A standardized

guideline that was well appraised and subsequently adapted by the clinical providers provided consistent, evidence-based patient care. The purpose of this DNP project was to develop and evaluate a CPG for the management of uncomplicated descending aortic dissection patients. The current CPG for the management of thoracic aortic disease by ACCF and AHA and recent research served as the basis in the development of the newly developed guideline for use in the target setting (See Appendix J). Anticipated outcomes of the project included achievement of quality measures such as decreased mortality, compliance with industry standards, and overall improvement of patient satisfaction.

### **Theoretical Framework**

Theoretical frameworks and models are devised to assist facilitation of knowledge and promote systematic ways of improving patient care (White and Dudley-Brown, 2012). According to White et al., (2012) the impact of failing to use new clinical knowledge to drive medical decisions is expensive and inefficient. Knowledge to Action (KTA) framework was created by Graham and colleagues to help explain and depict the process of facilitating knowledge into action (Field, Booth, Ilott, & Gerrish, 2014; Straus, Tetroe, & Graham, 2013). The providers utilized this framework to focus on the facilitation of knowledge about a particular idea or problem in medicine and applied the translation of that knowledge into action, which in turn led to a change in practice (Campbell, 2010). Straus, Tetroe, & Graham (2013) note that the creation of knowledge is formed from three different parts: 1) knowledge inquiry, 2) knowledge synthesis, and 3) the development of a knowledge tool (See Appendix D).

The first step of the action cycle of the KTA framework is to identify the practice problem. This step includes assessing the practice environment, identifying key stakeholders and setting the foundation for the creation of a CPG for the management of uncomplicated

descending aortic dissection patients. The next three steps in the cycle include: 1) applying the problem to local context, 2) assessing barriers to resolving the problem, and 3) selecting and tailoring the intervention (The Knowledge to Action framework, 2014). These steps were carried out during the project by identification of an expert panel who assisted in the creation of the CPG in the facility. The members of the expert panel represented a multidisciplinary cohort of providers who routinely treated aortic dissection patients. By using a multidisciplinary approach, the clinical knowledge was disseminated by means of introducing the CPG into clinical practice. The AGREE II tool was used to evaluate the CPG by the expert panel. Once the CPG was in satisfactory standing by the expert panel, it was presented to an Administration panel within the facility specific to the service line. Lastly, the providers evaluated the finalized CPG to assess its applicability and facilitate the standardized management of uncomplicated descending aortic dissection patients. This was performed by the providers working within the cardiac surgery service. The last step of the action cycle is sustaining the knowledge use. The utilization of the CPG into practice for this specific patient population, demonstrated the last step of the action cycle (See Appendix D).

### **Literature Review**

The current published Guideline for the Diagnosis and Management of Patients with Thoracic Aortic Disease published by the ACCF and AHA in 2010 and updated in 2013 was reviewed for this project. In addition, randomized controlled trials, nonrandomized trials, and expert clinical opinion, were reviewed to facilitate an updated assessment of clinical recommendations. The literature reviewed focused on the management of patients with descending aortic dissections, including: 1) background and epidemiology of descending aortic dissection, 2) pharmaceutical, surgical, and medical treatment, and 3) imaging methods for

follow-up management. A synthesis of the evidence in support of this DNP project will be provided at the end in this literature review. Refer to Appendix A for the evidence grading table.

The ACCF/AHA guideline included the review of 830 references. Evidence was ranked on a three-level system: 1) Level A was for data was from multiple randomized controlled trials or meta-analyses, 2) Level B was data from a single randomized trial or nonrandomized trials, and 3) Level C was from expert opinion, case studies or standards of care. The evidence was also categorized with Class I, II, and III according to size of effect: 1) Class I recommendations should be performed and carried out, 2) Class II are noted to be reasonable to be performed and have found to be helpful in some cases, and 3) Class III are not recommended (Hiratzka et al., 2010).

Although this literature review focused on uncomplicated aortic dissection, providers need to recognize the signs and symptoms of complicated aortic dissection, as these patients are in imminent risk of sudden death and require immediate intervention (Hiratzka et al., 2010). Patients presenting to the hospital with signs and symptoms of complicated aortic dissection such as chest or back pain plus high risk factors associated with aortic disease should have immediate aortic imaging and surgical evaluation. In addition to chest or back pain and a high risk history, certain exam findings suggesting ischemia such as a pulse deficit or systolic blood pressure differential between extremities should prompt providers to include complicated aortic dissection in the differential diagnosis list (Hiratzka et al, 2010). The remaining evidence for the creation of this CPG focused on uncomplicated descending aortic dissections.

Urgent and definitive imaging of the aorta using transesophageal echocardiogram (TEE), computed tomographic imaging (CT) scan with contrast, or magnetic resonance imaging (MRI) is indicated in patients with suspected aortic dissection. While all three imaging methods are

equally effective in diagnosing aortic dissection, CT scan or MRI are superior to TEE when establishing arch branch involvement (Erbel et al., 2014). Since this guideline only discusses the management of descending aortic dissections, the recommended choice of imaging for this population of patients is CT scan or MRI.

A Class I recommendation from the ACCF/AHA guidelines, includes the reduction of aortic wall stress by managing blood pressure and heart rate by means of various pharmaceutical agents (Hiratzka, 2010). First line agents include beta blockers to achieve a heart rate under 60 and systolic blood pressure under 120 mmHg. The CPG also recommended initiation of calcium channel blockers followed by angiotensin converting enzyme inhibitors if beta blockade is contraindicated, or if parameter goals cannot be achieved with beta blockers alone (Hiratzka et al, 2010). A univariate analysis of antihypertensive medications used in acute aortic dissection supported the use of beta blockers to improve five year survival rates ( $p=0.02$ ) (Suzuki et al., 2012). This analysis also revealed that calcium channel blockers which aid in aortic remodeling were associated with improved five year survival rates for medically managed descending aortic dissections ( $p=0.03$ ) (Suzuki et al., 2012).

In addition to heart rate and blood pressure control, the ACCF/AHA guideline endorses diagnostic imaging with CT scan or MRI at one month, three months, six months, and 12 months, to evaluate for aneurysmal growth and false lumen thrombosis (Hiratzka et al., 2013; Tsai et al., 2009). Surveillance imaging to assess aneurysmal growth is critical in evaluating the potential need for future aortic interventions, especially in those who are medically managed and have an increased risk of aneurysmal growth or rupture due to an enlarged aortic diameter of the false lumen greater than 2.2 cm and refractory pain (Song, Kim, Kim, Kim, Kang, Seo,...Song, et al., 2007; Trimarchi, Eagle, Nienaber, Pyeritz, Jonker, Suzuki,...Isselbacher, et al., 2010).

The Acute Dissection Stent Grafting or Best Medical Treatment (ADSORB) trial was the first prospective randomized controlled trial (RCT) to compare best medical therapy (BMT) and endoluminal stent graft (TAG) to BMT alone in uncomplicated descending aortic dissections (Brunkwall et al., 2012). The trial had a sample size of 61 patients with acute uncomplicated descending dissections and included 31 patients in the BMT group and 30 patients in the BMT and TAG group. The goal of blood pressure management for BMT was defined less than 120/80 mmHg (Brunkwall et al., 2012). The primary outcomes of the trial were to analyze one year results of incomplete false lumen thrombosis, aortic dilatation, and aortic rupture. Results of the trial showed a significant occurrence of incomplete false lumen thrombosis in 97% of the patients in the BMT group ( $p < 0.001$ ). The BMT and TAG group had a true lumen size increase along with a false lumen size decrease ( $p < 0.001$ ) compared to the BMT only group which were noted to have no change in the true lumen size with an increase in the false lumen size ( $p < 0.001$ ).

The Investigation of Stent Grafts in Aortic Dissection (INSTEAD) trial was a prospective RCT evaluating two year outcomes for patients treated with TEVAR versus medical therapy alone (Niemaber, 2011). End points were all cause mortality, aortic related mortality such as aortic rupture or malperfusion, and progression of disease. One hundred forty patients with subacute uncomplicated descending aortic dissection were randomized to TEVAR and medical treatment ( $n=72$ ) and compared to medical treatment alone ( $n=68$ ). The results revealed that aortic remodeling occurred at a rate of 91% in the TEVAR and medical treatment group compared to 19% in the medical treatment alone group ( $p < 0.001$ ) However, there was no significant impact on aortic related mortality in the TEVAR and medical treatment group during the initial two-year interval ( $p=0.28$ ).

This same group of investigators evaluated long term data on this same cohort of patients in a retrospective RCT entitled, Endovascular Repair of Type B Aortic Dissection: Long-Term Results of the Randomized Investigation of Stent Grafts in Aortic Dissection Trial (INSTEAD-XL) (Niemaber, et al., 2013). The patients were followed for a minimum of five and maximum of eight years. The retrospective review showed that systolic BP under 130 mmHg was maintained on antihypertensive medications for 90% of participants across both groups. TEVAR was necessary due to enlarged false lumen diameter for 14 out of 68 (20%) patients in the medical treatment only group. In the TEVAR and medical treatment group, additional aortic repair was necessary in seven out of 72 patients (nine percent). All-cause mortality was lower in the TEVAR and medical treatment group over five years but was not statistically significant ( $p=0.13$ ). Survival curves revealed that the TEVAR and medical treatment group demonstrated an improved survival benefit (100%) compared to the medical treatment alone group (83%) ( $p<0.003$ ). False lumen thrombosis at five years was seen in 90% of patients along with evidence of aortic remodeling in 79% of the TEVAR and medical treatment group ( $p<0.0001$ ). The medical treatment only group demonstrated an aortic diameter enlargement from 43 to 56 mm ( $p<0.0001$ ), with rare aortic remodeling (Niemaber et al., 2013). These findings demonstrate that TEVAR in the subacute phase of aortic dissection induces false lumen thrombosis with aortic remodeling and reduces aortic related mortality at over five years from initial presentation.

A review of the International Registry of Acute Aortic Dissection (IRAD) data identified that three-year survival rates for uncomplicated descending aortic dissection are as low as 78% (Tsai, Trimarchi, and Nienaber, 2009; Nienaber, 2011). According to Qin, Wang, Li, Ding, Deng, Xie, and Teng (2016), medical therapy alone without TEVAR carries a 30-50% risk of

mortality at five years from the onset of the dissection. TEVAR in addition to best medical therapy results in improved long term survival.

### **Synthesis of the Literature**

Consistently, the evidence supports that imaging of the aorta via a CT scan with contrast or MRI, is critical for the patients presenting with a high suspicion of dissection by means of clinical history and physical exam. However, consideration of diagnostic evaluation tools should be chosen based on patient acuity and facility resources (Hiratzka et al., 2010).

The evidence is consistent regarding the initial management of uncomplicated descending aortic dissection. Patients presenting with signs and symptoms of a complicated aortic dissection should be referred for emergent surgery. Otherwise, patients with uncomplicated aortic dissection should be treated medically with an antihypertensive regimen initially (Hiratzka, et al., 2010; Nienaber et al., 2013; Winnerkvist, Lockowandt, Rasmussen, & Radegran, 2006). Blood pressure and heart rate should be managed with the goal to reduce cardiac contractility and aortic shear wall force. This includes the use of beta blockers, calcium channel blockers, and vasodilators (unless contraindicated by an underlying medical condition) to achieve a heart rate under 60 and goal systolic blood pressure between 100 and 120 mmHg to allow for adequate renal perfusion (Brunkwall et al., 2012; Hiratzka et al., 2010; Tsai et al., 2009.).

Patients with aortic dissection should be followed with surveillance imaging at specific intervals of time such as one, three, six, and 12 months after discharge to evaluate for any aneurysmal change or enlargement of the dissection (Hiratzka et al., 2010). According to multiple studies, features such as an initial aortic diameter over four centimeters with a patent false lumen, refractory pain or hypertension, an initial large false lumen over 2.2 centimeters or intramural hematoma with development of a penetrating ulcer in the proximal portion of the

descending aorta, are features that are consistent with the development of late aneurysmal growth and aortic rupture, and therefore, put the patient at a higher risk of requiring future aortic intervention (Song et al., 2007; Trimarchi et al., 2010). Currently, the updated ACCF and AHA guidelines do not recommend endovascular repair for uncomplicated descending dissection patients, as there is no Level I evidence to support TEVAR in the acute phase of uncomplicated dissections. However, recent research is revealing improved long term outcomes with patients who receive TEVAR due to the resultant false lumen thrombosis and aortic remodeling, which should be beneficial especially in high risk patients (Nienaber, 2013).

Unfortunately, there is weak evidence only to guide providers as to the appropriate timeframe to intervene surgically. Future studies are still needed to best address this issue.

## **Methods**

### **Design, Sample and Setting.**

This DNP project involved the development and evaluation of a CPG for the management of patients with uncomplicated descending aortic dissection. An initial CPG draft (See Appendix J) was developed based on the current ACCF and AHA guidelines and updated with recently published evidence related to descending aortic dissection. Each phase of the project had a distinctly different design and sample. A timeline of the course of the implementation of this project is included in the appendix section (See Appendix B).

This DNP project was implemented in an urban, academic medical center on the East Coast. This site serves as a referral center for the International Registry of Aortic Dissection (Aortic Dissection, 2016). The clinicians who were involved in this project are in positions to implement the guideline into practice on the cardiac surgery service at the facility. The target population of the CPG were patients with uncomplicated descending aortic dissection who were

admitted to the cardiac surgery intensive care unit and/or the cardiac surgery telemetry step down unit. Both the intensive care unit and the telemetry step down units comprise the cardiac surgery service.

## **Procedures**

**Phase I.** The first phase of the evaluation of the draft CPG began with the recruitment of an expert panel to facilitate the review an evaluation of the draft CPG developed by the DNP student. At the target facility, patients with descending aortic dissection are mostly managed by the cardiac surgery team, however, there have been variabilities in management among the providers. Given that the facility is recognized as an IRAD facility, there was interest in devising a service specific guideline for the care of these. The panel included an attending cardiac surgeon, a senior nurse practitioner, and a pharmacist. The DNP student contacted the expert panel via email to schedule two meeting dates.

The initial meeting of the expert panel of providers occurred during the first month of implementation. During this meeting, the DNP student led a discussion about the overview of the CPG which included an explanation of the DNP Project, a discussion of the panel's roles in the project, an explanation of the AGREE II Tool, and a discussion of the agenda for the next meeting. The expert panel was given a draft of the CPG along with a copy of the relevant literature for their review.

Each member of the expert panel was asked to complete the AGREE II Tool to assess the quality of the draft CPG followed by the delivery of the AGREE II Tool to the DNP student for evaluation via hand delivery or email within two weeks of the initial meeting. The tools were reviewed in a face to face meeting two weeks from the initial presentation, which was the second

meeting time for the project. The CPG was then revised based on the recommendations of the expert panel, and was set for final approval during the second month of implementation.

**Phase II.** The second phase of the project involved meeting with the key administrators. These included the Director of the Aortic Program within the Division of Cardiac Surgery and the Clinical Program Manager of Advanced Practice on the Cardiac Surgery Step Down and Intensive Care Unit. Once the CPG gained approval from the key administrators, the project progressed into the third phase. The administrators did not recommend any revisions to the CPG, and therefore the original expert panel did not need to review the CPG after the administrators. However, the Director of the Aortic Program did confirm the necessity to designate the subacute phase of dissection as two weeks to 60 days, rather than 30 days. The panel was made aware and the CPG was revised to state this.

**Phase III.** The third phase of the project included the evaluation of the CPG by the nurse practitioner providers and attending surgeons of the cardiac surgery team with the Practitioner Feedback Survey tool. The sample included nine acute care nurse practitioners and three attending cardiac surgeons, who were all identified to be end users of the CPG. This sample number represents 71% of the cardiac surgery service providers (both nurse practitioners and attending surgeons). The sample for this phase did not include the nurse practitioner who functioned on the expert panel, nor two of the attendings who served as an expert panel member and key administrator. In addition, the sample also excluded two of the surgeons working within the service as they were both unavailable to review the guidelines within the implementation timeframe. The newly developed CPG was presented to the providers on the cardiac surgery service by the DNP student. For those nurse practitioners who were not available on the day of the guideline presentation to the group, a separate delivery was given to those three providers.

Following the presentation, the practitioners were asked to evaluate the CPG with the PFQ. The data collection process remained anonymous; however, the survey tool was modified to include data pertaining to total years of experience. Inclusion criteria for the sample selection included the requirement of independent provider functioning with ordering capability and active privileges at the facility. The providers also needed to currently work on the cardiac surgery service at the facility. Medical residents were excluded from this project as they are not independently functioning providers.

### **Data Collection and Analysis**

The expert panel assessed the quality and methodological strategy for the development of the CPG by using the AGREE II Tool (<http://www.agreetrust.org/>). This tool consists of 23 items that are divided into six domains that assess the quality of scope, purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability and editorial independence. The items on the AGREE II Tool were scored on a seven point Likert Scale. A score of one (strongly disagree) was given when there was no information in the CPG related to the AGREE II item or if the concept was poorly developed. A score of 7 (strongly agree) was given when full criteria of the AGREE II were met and the concept was exceptionally reported in the CPG. Then, a quality score was developed for each domain by adding all the scores given by the expert panel and calculating a total score as a percentage of the maximum score possible within each domain. A low score may not imply poor CPG quality; however, it provided an opportunity to discuss the evidence and address recommendations for revision.

The reliability and validity of the AGREE II tool was established by the AGREE Collaboration in 2003. Reliability was calculated among the 23 domains of the tool by measuring internal consistency and inter-rater reliability measured between 0.25 and 0.91 (MacDermid,

Brooks, Solway, Switzer-McIntyre, Brosseau, & Graham, 2005). Criterion validity was assessed by ranking correlation scores and overall assessment scores of the appraisers, with significant correlation (MacDermid et al., 2005). After the AGREE tool was published, the committee made revisions to the tool to develop the AGREE II tool in 2009, with further updates in 2013 (Brouwers et al., 2010).

During Phase III of the project, The Practitioner Feedback Questionnaire (PFQ) was used by the providers to evaluate the newly developed CPG. This tool is comprised of 23 items that reflect scientific quality, methodological rigor, implement-ability, applicability, and acceptability of the CPG. Items in the tool were scored on a three-point scale that included “strongly agree, neither agree or disagree, and strong disagree.” (See Appendix C). The results of the PFQ were reported with descriptive statistics.

The PFQ has highly rated internal consistency between 0.75 and 0.85 (Brouwers, Graham, Hanna, Cameron, & Browman, 2004). The validity of the tool was measured by use of a multilevel modeling technique on differences among guidelines being evaluated, differences in practitioners evaluating the information, and unexplained differences or residuals. Brouwers et al., (2004) found that each of these factors had a statistically significant ( $\leq p.0001$ ) predictive influence on the guidelines’ ratings.

### **Measures to Protect Human Rights**

This DNP project proposal was presented to the DNP Project Team for approval. Once the project was approved, the proposal was submitted to the University of Maryland Baltimore (UMB) Institutional Review Board (IRB) for a Non Human Subjects Research (NHSR) determination prior to the initiation of any of the project’s implementation. The facility of implementation utilizes the UMB IRB. The PFQ was modified to include the years of experience

of the subject who was completing the tool. To maintain anonymity, no subject demographic information will be collected. All subjects were informed that their participation is completely voluntary. The practitioners completed the anonymous PFQ surveys following the presentation of the CPG by the DNP student. After the presentation of the guideline, the DNP student left the room so that the participants could complete the surveys in private. The surveys were left in a secure area of room for collection at a later time. Those providers who were not present for the presentation of the guidelines were instructed to leave their completed PFQs in a locked office on the unit and were collected by the DNP student. All information gathered will be stored in a locked cabinet in the DNP student's office and on a password protected computer.

### **Outcomes**

The primary outcome of this DNP project was the development and evaluation of a CPG for the management of uncomplicated descending aortic dissection. The end users, the providers of patient care, assessed adaptability and usability of the CPG for management of patients with uncomplicated descending aortic dissection patients by means of the practitioner feedback questionnaire. The AGREE II tool assessed the quality and methodological rigor of the CPG with review of the feedback from the end users, the guideline is projected for use in the management of these patients on the service, however, the guideline implementation was beyond the scope of this scholarly project. Ultimately, this CPG will standardize care of the patient with uncomplicated descending aortic dissection and improve patient outcomes.

### **Results**

As described in the methods section, by means of a rigorous review of the literature on the management of uncomplicated descending aortic dissection, a draft CPG was created. After review and appraisal of the draft CPG by the expert panel, the CPG was then revised and

addended. The appraisal of the CPG was facilitated by utilizing the AGREE II tool. A quality score was calculated by the student for each of the six domains. The score was derived by adding up the value that was given by each appraiser for each domain and scaling that total as a percentage of the maximum score (See Appendix F). It is important to note that for questions that resulted in a “n/a” from the appraiser, this was designated with a “2” rather than eliminating the entire question. The AGREE II appraisal scores from the expert panel were overall favorable; 1) Scope and Practice (98%), 2) Stakeholder Involvement (98%), 3) Rigour of Development (92%), 4) Clarity of Presentation (90%), 5) Applicability (86%), and 6) Editorial Independence (94%). The revisions made to the CPG after appraisal by the panel included specifying the choice of imaging modality for the patient population to be determined by creatinine and/or contrast allergy, specific listing of pharmaceutical agents recommended for heart rate and blood pressure control, recommending against the use of hydralazine as this can cause rebound tachycardia, and the development of an algorithm for providers to use as quick visualization that summarizes the inpatient management of uncomplicated descending aortic dissection (See Appendix E).

The student then met with the Administrative panel, both the Director of the Aortic Program and the Clinical Program Manager of Advanced Practice on the Cardiac Surgery Step Down and Intensive Care Unit to present the CPG. After this meeting, the CPG was accepted for use within the service with one change in acuity classification. The Director of the Aortic Program felt that the subacute classification of these patients needed to be changed to two weeks to 60 days, rather than 30 days. This change was completed and further reviewed and accepted by the expert panel.

The final CPG was disseminated by means of a verbal presentation to the nurse practitioners and surgeons among the service and evaluated by the PFQ. The providers that were not able to attend the verbal presentation were provided the guideline by means of email. The PFQ was also attached to the CPG with instructions to complete and return to a locked office for the DNP students' pick up within 24-48 hours. Seven nurse practitioner providers and one surgeon returned the PFQs, resulting in a total respondent rate of 66%. Seventy-five percent of the respondents had five or less years of experience in their role, while 25% of the respondents had 10-20 years of experience.

The PFQ is a 23-question survey with question one asking if the provider was responsible for the care of patients served by this guideline. This question was not calculated in the result totals as all subjects were responsible, and it was a "yes or no" response rather than the Likert style scoring of the remaining questions. The remaining questions were graded with the options of "strongly agree, neither agree nor disagree, or strongly disagree". All but four questions of the survey were graded with the response of "strongly agree" being the optimal score. Due to the structure of the questions of four items on the PFQ, it was necessary to inversely grade them with the response of "strongly disagree" representing a higher agreeability score. In addition, question 18 was unintentionally omitted from the copy of surveys that were dispersed, therefore all scoring calculations were taken out of 21 questions rather than 23. This question inquired whether or not the respondent agreed that the CPG reflected a more effective approach for improving patient outcomes than current practice. All results were inputted into Excel for statistical comparison and analysis. The summary of the results can be seen in Appendices G, H, and I.

The results showed a total percentage of agreement to the questions on the PFQ, with seventy-nine percent of respondents that they agree with the questions. Eighty-eight percent of the respondents felt there was a real need for a guideline in the management of uncomplicated descending aortic dissection. One hundred percent of the respondents felt that the recommendations in the guideline were clear and that they were in agreement with the recommendations. In addition, one hundred percent of the respondents felt that the CPG would produce more benefits for the patients than harm, as well as that utilization of the guideline will result in a better use of resources than the current practice. Further, the survey questions were analyzed according to the subsections of interest for the PFQ. These categories include quality, acceptance of recommendations, applicability of recommendations, comparative value, and outcome variables. The percentage of agreement for these sections are listed in Appendix I. The subsection which scored the lowest in agreeability was the applicability of recommendations questions (41% strongly agreed). This section was comprised of all the inversely graded questions. The respondents were not made aware of the change in question format which may have led to confusion in choosing the appropriate response.

## **Discussion**

The successful implementation of the CPG for this patient population requires acceptance and ease of use by the providers. The administrative acceptance of the CPG by the Director of the aortic program will carry significant weight in the successful translation of evidence to practice. However, there were a few limitations of the project. The sample size was small, and it was challenging to reach all providers in one setting which may have contributed to a lower rate of returned surveys. There was no forum to have all providers sit together to receive presentation of the guidelines. The surgeons requested individual presentation of the CPG either through

verbal or email communication, requiring the PFQ to be completed electronically and submitted through email. Verbal presentation to the surgeons was challenging given the unpredictable nature of their schedules and overall business of the service.

Other limitations of the project were the unintentional elimination of one of the questions on the survey as well as not informing provider respondents about the inversely scored questions on the survey. The eliminated question asked if the CPG recommendations reflected a more effective approach for improving patient outcomes than the current practice. However, this question is a bit more abstract and is somewhat addressed with other questions on the questionnaire. The inversely scored questions under the interest subsection of applicability of recommendations scored poorly in agreeability. This may be related to respondents being unaware of a change in structure of the survey question. The DNP student could have highlighted to the participants the change in structure of specific questions during the instruction period prior to distributing the survey.

Given the specialization of the surgeons within the service, the chief of the division advised that gaining approval from the Director of the Aortic Program would help to create a unified management style and preference among the surgeon group. To improve the process of evidence translation and future implementation of the CPG among the service, the usability and accessibility of the CPG contents were important to the DNP student. An algorithm was designed with input from the expert panel to provide a quick one sheet resource for providers to utilize when faced with the management of patients with uncomplicated descending aortic dissections. Another step that was taken by the DNP student to aid in the translation process was the delivery of the guideline to the outpatient nurse practitioner who will be following this patient population once discharge occurs. While this provider was not included in the subject population as she

would not be implementing the guideline, it is important for her to be aware of the inpatient process to provide a continuum of care in the outpatient setting.

**Conclusion**

The general positive scores of the AGREE II appraisals as well as the PFQ score show an acceptance of the CPG by the cardiac surgery providers. The purpose of this DNP project was to develop and evaluate a CPG for the management of uncomplicated descending aortic dissection patients, which was achieved. By translating the evidence into practice and implementing the CPG, the achievement of quality measures such as decreased mortality, compliance with industry standards, and overall improvement of patient satisfaction should occur.

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## Appendix A

Evidence Rating Table

| Author, year                                                                                              | Study objective/intervention or exposures compared                                                                                                                                                                       | Design                                                                   | Sample (N) | Outcomes studied (how measured)                                                                                                                                   | Results                                                                                                                                                                                                                                                        | *Level and Quality Rating |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Suzuki, T., Isselbacher, E., Nienaber, C., Pyeritz, R., Eagle, K., Tsai, T.,...Froehlich, J. (2012).      | Effects of medications on patients with acute aortic dissection were reviewed in a retrospective data base review. Beta blockers, calcium channel blockers and other drug classes were reviewed for impact on mortality. | Retrospective data base study                                            | N=1301     | All-cause mortality with use of beta blockers, calcium channel blockers, diuretics, vasodilators, and ACE inhibitors in both ascending and descending dissection. | Beta blockers were associated with improved outcomes in both sets of patients. Calcium channel blockers were associated with improved survival selectively with descending dissections.                                                                        | III<br>B                  |
| Erbel, R., Aboyans, V., Boileau, C., Bossone, E., Di Bartolomeo, R., Eggebrecht, H.,...Vrints, C. (2014). | Clinical practice guidelines for management of acute aortic syndromes                                                                                                                                                    | Clinical practice guideline written for management of aortic dissection. | N/A        | Guidelines were reviewed and focused analysis was made on the management of uncomplicated type b aortic dissection.                                               | Treatment recommended included medical therapy to control pain, HR, BP, with close surveillance to assess for disease progression or malperfusion, repeat imaging with CT or MRI, use of TEVAR to prevent late complications and aims at stabilizing the aorta | IA                        |

|                                                                                                     |                                                                                                                                                                                                             |                                           |       |                                                                                                                                                                      |                                                                                                                                                                                                                                |          |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Brunkwall, J., Kasprzak, P., Verhoeven, E., Heijmen, R. (2014).                                     | Comparison of best medical treatment with best medical treatment and stent graft repair to evaluate false lumen thrombosis, dilatation, and aortic rupture at 1 years' time.                                | Prospective randomized controlled trial   | N= 61 | Rate Of false lumen thrombosis, aortic dilatation, and aortic rupture were measured.                                                                                 | Results revealed that stent graft and medical therapy group were significantly effective in all endpoints. Remodeling was higher in the stent graft and medical therapy group in comparison to the medical therapy group only. | I<br>B   |
| Nienaber, C. (2011).                                                                                | Review of the INSTEAD trial                                                                                                                                                                                 | Retrospective review RCT                  | N=140 | Interpretation of the findings of the INSTEAD trial.                                                                                                                 | The trial revealed that aortic remodeling was favorable in the TEVAR (intervention group), however the study failed to show improvement in survival within 2 year follow-up period.                                            | II<br>C  |
| Nienaber, C., Kische, S., Rousseau, H., Eggebrecht, H., Rehders, T., Kundt, G., ...Ince, H. (2013). | Descending aortic dissections randomized to medical therapy or TEVAR with medical therapy in previous INSTEAD trial; This study is the INSTEAD XL and looked at long term outcomes (between 2 and 5 years). | Retrospective randomized controlled trial | N=140 | Aortic specific, all cause outcomes, and disease progression using landmark statistical analysis of years 2-5 after the original randomization of the INSTEAD trial. | All cause mortality, aorta-specific mortality, and progression was lower after 5 years with TEVAR compared to medical therapy. TEVAR induced false lumen thrombosis at 5 years in 90.6% of patients.                           | II<br>A  |
| Qin, Y., Wang, F., Li, T., Ding, W., Deng, G., Xie, B...Teng, G. (2016).                            | Early and long term outcomes of TEVAR compared to outcomes of                                                                                                                                               | Retrospective cohort study                | N=338 | Aortic and all cause mortality was assessed for the two groups.                                                                                                      | Patients with medical therapy only had higher aortic related adverse events compared with                                                                                                                                      | III<br>B |

|                                                            |                                                                                                                         |                                                                                                                |                                                                |                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                   |    |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                                                            | medical therapy in uncomplicated descending dissection patients over an 11 yr period.                                   |                                                                                                                |                                                                |                                                                                                                                                       | those in the TEVAR group (p=0.025). All cause mortality was lower in TEVAR group than medical therapy (p=0.01). Recommends TEVAR in uncomplicated acute dissections to improve late outcomes.                                                                                                                                                                                                                     |    |
| Field, B., Booth, A., Ilott, I., & Gerrish, K. (2014).     | Systematic review that aimed to address a knowledge gap regarding the use of Knowledge to Action Framework in practice. | Citation analysis and systematic review of the literature on utilization of the Knowledge to Action Framework. | 146 Studies were reviewed 10 studies integrated the framework. | Utilization of the Knowledge to Action framework in research studies.<br><br>Taxonomy scale was created to identify the quality of the framework use. | Out of 146 studies that attributed the use of the framework, only 10 studies (7%) had actually integrated the framework meaning that the framework was integral to the design, delivery and eval of the activity of the study.<br><br>Most studies that used the framework best were those of an implementation design.<br><br>Recommendation to use taxonomies when evaluating knowledge translation strategies. | IA |
| Hiratzka, L.F., Bakris, G.L., Beckman, J.A., Bersin, R.M., | Clinical guidelines of patients with thoracic aortic disease.                                                           | Clinical practice guidelines                                                                                   | N/A                                                            | Systematic review of RCT for clinical practice guideline creation                                                                                     | Guidelines described for blood pressure management of dissection patients regardless of                                                                                                                                                                                                                                                                                                                           | IA |

|                                                                                  |                                                                                                                                                        |                                                                |                                  |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <p>Carr, V.F. Casey, D.J.,...<br/>Williams, D.M. (2013).</p>                     |                                                                                                                                                        |                                                                |                                  |                                                                                                                                                                     | <p>surgical repair or medical management. Surveillance monitoring with CT or MRI of these patients was described.</p>                                                                                                                                                                                                                                                                                                                                                          |                  |
| <p>Winnerkvist, A., Lockowandt, U., Rasmussen, E., &amp; Raderan, K. (2006).</p> | <p>A prospective study to examine aortic related outcomes in patients with acute type B aortic dissections who were not surgical candidates.</p>       | <p>Prospective cohort study</p>                                | <p>N= 66</p>                     | <p>aneurysm formation, incidence of rupture, and mortality in patients over a time period of six years.</p>                                                         | <p>Conservative treatment of these patients has a low incidence of aneurysm formation and rupture in the chronic phase. Event free rates at 5 years was 75% and at 10 years was 67%.</p>                                                                                                                                                                                                                                                                                       | <p>IVB</p>       |
| <p>Tsai, T.T., Trimarchi, S., &amp; Nienaber, C.A. (2009).</p>                   | <p>Provides an update on the IRAD registry data since the number of patients enrolled increased and consists of more center sites internationally.</p> | <p>Retrospective observational study of the IRAD registry.</p> | <p>N=2000 enrolled patients.</p> | <p>Clinical presentation and type of dissection, prognosis, imaging, therapeutic conservative approaches and followup management of aortic dissection patients.</p> | <p>Followup management factors include medical therapy, serial imaging of the dissection, and reoperation if clinically indicated.</p> <p>The access to acute cases of aortic dissection will allow for research of biomarkers to detect aortic rupture.</p> <p>IRAD continues to increase awareness of the disease and with the identification of referral centers internationally, this can encourage a pathway to clinical excellence in this disease state management.</p> | <p>III<br/>A</p> |

|                                                                                                           |                                                                                                                                                 |                                              |        |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Tsai, T., Fattori, R., Trimarchi, S., Isselbacher, E., Myrmet, T., Evangelista, A... Nienaber, C. (2006). | 242 IRAD patients dx with acute type B dissections were assessed for factors associated with long term survival.                                | Retrospective data base review that examined | N=242  | Measurable outcomes were method of treatment, occurrence of aortic aneurysm prior to dissection, age, history of hypertension, hx of atherosclerosis, renal failure, and size of aorta.                                                                                                              | Mortality rates of acute type b dissection patients is high with 1 out of every 4 patients not surviving at 3 years from discharge. In hospital management, gender, and age contributed to predictors of mortality rates at followup. 31-66% of follow up deaths were due to aortic related complications such as rupture, extension of dissection, and perioperative mortality from subsequent aortic repairs. | IVA |
| Trimarchi, S. Eagle, K., Nienaber, C., Pyeritz, R., Jonker, F., Suzuki, T,... Isselbacher, E. (2010).     | Retrospective study that evaluated the impact of refractory pain or hypertension in the outcome of acute descending aortic dissection patients. | Retrospective database cohort review         | N= 365 | 365 patients with acute type B dissection were categorized into two groups. Grp 1 patients with refractory pain or hypertension which were immediate risk. Group 2: had no refractory pain or hypertension and were classified as low risk. Hospital mortality rates, demographics, patient history, | Uncomplicated desc aortic dissection patients who receive medical management have excellent outcomes, however, those with refractory pain or hypertension have higher mortality rates especially when treated along with medical therapies. Patients in group 2 were medically managed more often than patients in group 1 (87.8% versus 24.6%, p<0.001)                                                        | IVA |

|                                                                            |                                                                                                   |                            |       |                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                                                                            |                                                                                                   |                            |       | clinical presentation, physical findings, imaging, management, and adverse events were measurable outcomes in the study.                              | The timeframe to invasive treatment from onset was longer (endovascular vs open surgery) in group 1 than group 2 (240 hours vs 100 hours = p=0.005) In overall hospital mortality rate of group 1 compared to group 2 (17.4% vs 4% p=0.0003. In hospital mortality for medical management of group 1 was 35.6% compared to group 2 1.5% p=0.019 In summary, patients who are low risk have a very low mortality rate with medical management, however patients with refractory pain or hypertension who are treated with surgery or stent graft have improved outcomes (group 1 mortality of med management vs surgery vs stent graft is 35.6% vs 20% vs 3.7% respectively) |     |
| Song, J., Kim, S., Kim, J., Kim, M., Kang, D., Seo, J.,...Song, J. (2007). | Study done to identify early predictors of late aneurysmal aortic change after aortic dissection. | Retrospective cohort study | N=100 | Measured outcomes included patient age, fender, presence of marfan’s disease, diabetes, hypertension, how long the patient was monitored, and initial | The upper descending thoracic aorta is a major area of aortic aneurysmal change. The initial false lumen diameter at presentation was most powerful predictor of late aortic aneurysm formation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | IVB |

|  |  |  |  |                                                                                                                                                                                                                                                                                            |                                                                                                                                         |  |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  |  |  | <p>measurements and over time of the aortic arch, upper, mid, and lower descending aortic aorta, as well as abdominal aortic size. This was done via clinical observation CT scans done over the span of 53 +/- 26 months and CT surveillance studies were done over 31 +/- 27 months.</p> | <p>False lumen size of over 2.2 cm was linked to accelerated aortic dilation, development of aneurysms and adverse clinical events.</p> |  |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--|

Appendix B

Scholarly project timeline

- a. Finalization and submission of the project proposal to DNP scholarly project committee members by March of 2017.
- b. Scholarly project proposal to the committee by April of 2017.
- c. Submit project proposal of the IRB query to University of Maryland, Baltimore by April of 2017.
- d. Project implementation and ongoing expert panel meetings from April to May of 2017.
- e. Data analysis including internal aggregate data and clinician evaluation of the practice guideline by the end of July of 2017.
- f. Submission of scholarly project manuscript to committee for review by July of 2017.
- g. Presentation of final scholarly project to the committee by July of 2017.

Appendix C

**Practitioner Feedback Questionnaire**

How many years of experience do you have in this role (circle one)? 0-5    6-10    11-15    16-20    20 or more

For each item, please check off the box that most adequately reflects your opinion.

|                                                                                                                                                                                                                          |                                                    |                                                               |                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------|
| <p>1. Are you responsible for the care of patients for whom this draft guideline report is relevant? This may include the referral, diagnosis, treatment, or follow-up of patients.</p>                                  | <p>Yes<br/><input type="checkbox"/></p>            | <p>No<br/><input type="checkbox"/></p>                        | <p>Unsure<br/><input type="checkbox"/></p>            |
| <p>If you answered “No” or “Unsure”, there is no need to answer or return this questionnaire. If you answered “Yes”, please answer the questions below and return to <b>[enter expected destination of surveys]</b>.</p> |                                                    |                                                               |                                                       |
|                                                                                                                                                                                                                          | <p>Strongly agree<br/><input type="checkbox"/></p> | <p>Neither agree or disagree<br/><input type="checkbox"/></p> | <p>Strongly disagree<br/><input type="checkbox"/></p> |
| <p>2. The rationale for developing a guideline is clear.</p>                                                                                                                                                             | <p><input type="checkbox"/></p>                    | <p><input type="checkbox"/></p>                               | <p><input type="checkbox"/></p>                       |

|                                                                                                                                                                 |                          |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <p>3. There is a need for a guideline on this topic.</p>                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p>4. The literature search is relevant and complete (e.g., no key evidence was missed nor any included that should not have been) in this draft guideline.</p> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p>5. I agree with the methodology used to summarize the evidence included in this draft guideline.</p>                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p>6. The results of the evidence described in this draft guideline are interpreted according to my understanding of the evidence.</p>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p>7. The draft recommendations in this report are clear.</p>                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p>8. I agree with the draft recommendations as stated.</p>                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                                    |                                 |                                 |                                 |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <p>9. The draft recommendations are suitable for the patients for whom they are intended.</p>                      | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>10. The draft recommendations are too rigid to apply to individual patients.</p>                                | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>11. When applied, the draft recommendations will produce more benefits for patients than harms.</p>             | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>12. The draft guideline presents options that will be acceptable to patients.</p>                               | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>13. To apply the draft recommendations will require reorganization of services/care in my practice setting.</p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>14. To apply the draft guideline recommendations will be technically challenging.</p>                           | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |

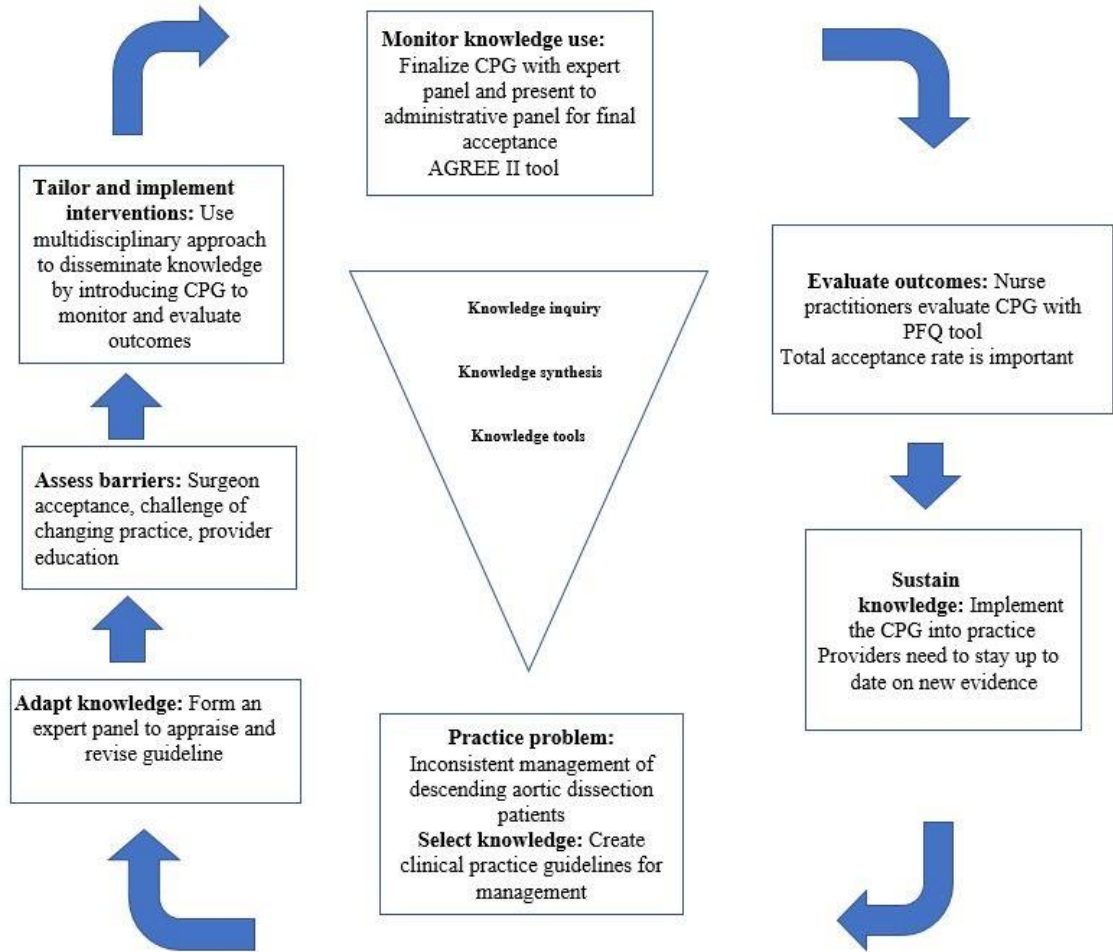
|                                                                                                                                                                                                                          |                                 |                                 |                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <p>15. The draft guideline recommendations are too expensive to apply.</p>                                                                                                                                               | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>16. The draft guideline recommendations are likely to be supported by a majority of my colleagues.</p>                                                                                                                | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>17. If I follow the draft guideline recommendations, the expected effects on patient outcomes will be obvious.</p>                                                                                                    | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
|                                                                                                                                                                                                                          | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>19. When applied, the draft guideline recommendations will result in better use of resources than current usual practice. (If they are the same as current practice, please tick NA). NA <input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |

|                                                                                                                                   |                                 |                                 |                                 |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <p>20. I would feel comfortable if my patients received the care recommended in the draft guideline.</p>                          | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>21. This draft guideline should be approved as a practice guideline.</p>                                                       | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>22. If this draft guideline were to be approved as a practice guideline, I would use it in my own practice.</p>                | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |
| <p>23. If this draft guideline were to be approved as a practice guideline, I would apply the recommendations to my patients.</p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> | <p><input type="checkbox"/></p> |

Adapted from: Brouwers, M.C., Graham, I.D., Hanna, S.E., Cameron, D.A., & Browman, G.P. (2004). Clinicians' assessments of practice guidelines in oncology: The CAPGO survey. *International Journal of Technology Assessment in Health Care*, 20(4), 421-426.

Appendix D

Modified Knowledge to Action Framework



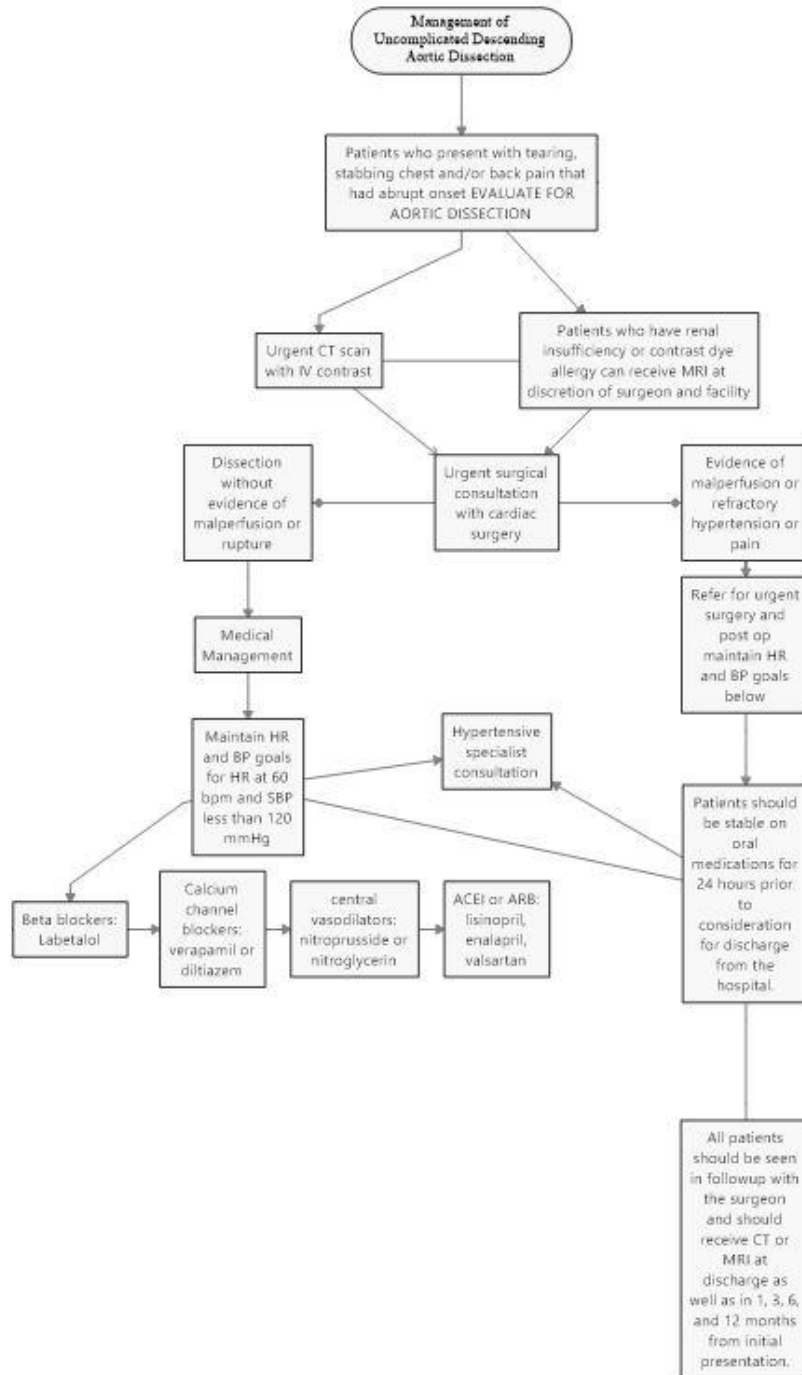
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publications

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Appendix E

Management of Uncomplicated Descending Aortic Dissection Algorithm



## Appendix F

*Domain 1: Scope and Purpose*


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|             | Item 1 | Item 2 | Item 3 | Total |
|-------------|--------|--------|--------|-------|
| Appraiser 1 | 7      | 7      | 6      | 20    |
| Appraiser 2 | 7      | 7      | 7      | 21    |
| Appraiser 3 | 7      | 7      | 7      | 21    |
| Total       | 21     | 21     | 20     | 62    |

Maximum possible score= 7 (strongly agree) x 3 (items) x 3 (appraisers)= 63

Minimum possible score= 1 (strongly disagree) x 3 (items) x 3 (appraisers)= 9

$$(62-9)/(63-9)$$

$$(53/54) \times 100$$

$$(0.98) \times 100 = 98\%$$

*Domain 2: Stakeholder Involvement*


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|             | Item 4 | Item 5 | Item 6 | Total |
|-------------|--------|--------|--------|-------|
| Appraiser 1 | 6      | 7      | 7      | 20    |
| Appraiser 2 | 7      | 7      | 7      | 21    |
| Appraiser 3 | 7      | 7      | 7      | 21    |
| Total       | 20     | 21     | 21     | 62    |

Maximum possible score = 7 (strongly agree) x 3 (items) x 3 (appraisers)= 63

Minimum possible score = 1 (strongly disagree) x 3 (items) x 3 (appraisers) = 9

$$(62-9)/(63-9)$$

$$53/54 \times 100$$

$$(0.98) \times 100 = 98\%$$

*Domain 3: Rigour of Development*

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|             | Item 7 | Item 8 | Item 9 | Item 10 | Item 11 | Item 12 | Item 13 | Item 14 | Total |
|-------------|--------|--------|--------|---------|---------|---------|---------|---------|-------|
| Appraiser 1 | 7      | 7      | 7      | 6       | 7       | 7       | 7       | 7       | 55    |
| Appraiser 2 | 7      | 7      | 7      | 7       | 7       | 5       | 7       | 2       | 49    |
| Appraiser 3 | 7      | 7      | 6      | 7       | 7       | 7       | 7       | 5       | 53    |
| Total       | 21     | 21     | 20     | 20      | 21      | 19      | 21      | 14      | 157   |

Maximum possible score = 7 (strongly agree) x 8 (items) x 3 (appraisers) = 168

Minimum possible score = 1 (strongly disagree) x 8 (items) x 3 (appraisers) = 24

$$(157-24)/(168-24)$$

$$133/144 \times 100$$

$$(0.92) \times 100 = 92\%$$

*Domain 4: Clarity of Presentation*

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|             | Item 15 | Item 16 | Item 17 | Total |
|-------------|---------|---------|---------|-------|
| Appraiser 1 | 6       | 7       | 7       | 20    |
| Appraiser 2 | 6       | 6       | 7       | 19    |
| Appraiser 3 | 6       | 6       | 7       | 19    |
| Total       | 18      | 19      | 21      | 58    |

Maximum possible score = 7 (Strongly agree) x 3 (items) x 3 (appraisers) = 63

Minimum possible score = 1 (strongly disagree) x 3 (items) x 3 (appraisers) = 9

$$(58-9)/(63-9)$$

$$49/54 \times 100$$

$$(0.90) \times 100 = 90\%$$

*Domain 5: Applicability*

---

|             | Item 18 | Item 19 | Item 20 | Item 21 | Total |
|-------------|---------|---------|---------|---------|-------|
| Appraiser 1 | 7       | 6       | 2       | 6       | 21    |
| Appraiser 2 | 6       | 7       | 7       | 7       | 27    |
| Appraiser 3 | 6       | 7       | 6       | 7       | 26    |
| Total       | 19      | 20      | 15      | 20      | 74    |

Maximum possible score = 7 (strongly agree) x 4 (items) x 3 (appraisers) = 84

Minimum possible score = 1 (strongly disagree) x 4 (items) x 3 (appraisers) = 12

$$(74-12)/(84-12)$$

$$62/72 \times 100$$

$$(0.86) \times 100 = 86\%$$

*Domain 6: Editorial Independence*

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|             | Item 22 | Item 23 | Total |
|-------------|---------|---------|-------|
| Appraiser 1 | 6       | 6       | 12    |
| Appraiser 2 | 7       | 7       | 14    |
| Appraiser 3 | 7       | 7       | 14    |
| Total       | 20      | 20      | 40    |

Maximum possible score = 7(Strongly agree) x 2 (items) x 3 (appraisers) = 42

Minimum possible score = 1(strongly disagree) x 2 (items) x 3 (appraisers) = 6

$$(40-6)/(42-6)$$

$$34/36 \times 100$$

$$(0.94) \times 100 = 94\%$$

Appendix G

Practitioner Feedback Survey Results

*Practitioner Feedback Survey Results*

| <b>Yrs of experience</b> | 16-20 | 6-10  | 0-5   | 0-5   | 0-5   | 0-5   | 0-5   | 0-5   |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Item#</b>             | PFS 1 | PFS 2 | PFS 3 | PFS 4 | PFS 5 | PFS 6 | PFS 7 | PFS 8 |
| 2                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 3                        | 1     | 2     | 1     | 1     | 1     | 1     | 1     | 1     |
| 4                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 5                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 6                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 7                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 8                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 9                        | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 10                       | 1     | 3     | 1     | 1     | 2     | 2     | 3     | 3     |
| 11                       | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 12                       | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 13                       | 1     | 3     | 1     | 2     | 2     | 2     | 3     | 3     |
| 14                       | 2     | 3     | 1     | 2     | 3     | 3     | 3     | 3     |
| 15                       | 3     | 3     | 1     | 2     | 2     | 2     | 1     | 1     |
| 16                       | 1     | 1     | 1     | 2     | 2     | 1     | 1     | 1     |
| 17                       | 2     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |

---

|    |     |     |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 18 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 19 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 20 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 21 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 22 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 23 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |

*Strongly Agree= 1*

*Neither agree or disagree= 2*

*Strongly Disagree=3*

## Appendix H

## Practitioner Feedback Questionnaire

*Practitioner Feedback Questionnaire Percentage (%) Response per Survey*


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| Item # | Strongly Agree (%) | Neither Agree or Disagree<br>(%) | Strongly Disagree (%) |
|--------|--------------------|----------------------------------|-----------------------|
| 2      | 100%               | 0%                               | 0%                    |
| 3      | 88%                | 13%                              | 0%                    |
| 4      | 100%               | 0%                               | 0%                    |
| 5      | 100%               | 0%                               | 0%                    |
| 6      | 100%               | 0%                               | 0%                    |
| 7      | 100%               | 0%                               | 0%                    |
| 8      | 100%               | 0%                               | 0%                    |
| 9      | 100%               | 0%                               | 0%                    |
| 10     | 38%                | 25%                              | 38%                   |
| 11     | 100%               | 0%                               | 0%                    |
| 12     | 100%               | 0%                               | 0%                    |
| 13     | 38%                | 38%                              | 25%                   |
| 14     | 63%                | 25%                              | 13%                   |
| 15     | 25%                | 38%                              | 38%                   |
| 16     | 75%                | 25%                              | 0%                    |
| 17     | 88%                | 13%                              | 0%                    |

|    |      |    |    |
|----|------|----|----|
| 18 | 0%   | 0% | 0% |
| 19 | 100% | 0% | 0% |
| 20 | 100% | 0% | 0% |
| 21 | 100% | 0% | 0% |
| 22 | 100% | 0% | 0% |
| 23 | 100% | 0% | 0% |

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## Appendix I

*Subsections of Interest for Practitioner Feedback Questionnaire*

|                                    | Percentage of<br>“strongly agree” | Questions                   |
|------------------------------------|-----------------------------------|-----------------------------|
| Subsection per interest of the PFQ |                                   |                             |
| Quality                            | 98%                               | Questions 2-7               |
| Acceptance of Recommendations      | 94%                               | Questions 8-9, 11-12, 16-17 |
| Applicability of Recommendations   | 41%                               | Questions 10, 13-15         |
| Comparative Value                  | 100%                              | Questions 18-19             |
| Outcome Variables                  | 100%                              | Questions 21, 23            |

## Appendix J

## Clinical Practice Guideline for the Management of Uncomplicated Descending Aortic Dissection Patients

**Background**

Thoracic aortic dissection occurs when a tear or rupture in the layers of the aorta create a true and false lumen which can result in organ malperfusion, paralysis, aortic rupture, and even death (Patel and Arora, 2008). Descending thoracic aortic dissection is a complex pathology which occurs in approximately 3 out of every 100,000 people annually (Nauta et al., 2016). Complicated dissections account for 15-20% of all descending aortic dissections and occur when the patient exhibits any signs of organ malperfusion, rupture or impending rupture, persistent pain, or refractory hypertension not responsive to medical therapy. Complicated dissections are most often treated with surgical repair (Hughes, Anderson, & McCann, 2013; Hiratzka et al., 2010). However, the majority of descending aortic dissections are uncomplicated. The current guideline by The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) recommends medical management of these patients (Hiratzka et al., 2013). However, evidence from more recent clinical trials reveals poor long-term outcomes in medically managed patients with uncomplicated dissections. Therefore, a revision to the current clinical practice guideline (CPG) to include surgical considerations plus recommended medical management of the uncomplicated aortic dissections is necessary.

**I. Scope and Purpose**

- A. **Objective:** The development of this CPG serves to update and standardize the management of uncomplicated descending thoracic aortic dissection patients for a cardiac surgery service at a large, urban academic medical center on the East coast that is identified as a large referral center by the International Registry for Aortic Dissection (IRAD) ([www.iradonline.org](http://www.iradonline.org), 2016). This CPG will provide sufficient description of background information, imaging modalities, treatment strategies, and risk factor modification aimed at smoking cessation and blood pressure

management. The implementation of a standardized guideline that is well appraised and subsequently adapted by the end users, can assist the practitioners and facility to practice with well supported standards of care for this population of patients and

- B. **Health Question Covered by the Guideline:** What is the most appropriate diagnostic approach to the patient suspected of an aortic aneurysm dissection? What is the best initial management of uncomplicated, descending thoracic aortic dissection?
- C. **Target Population:** Uncomplicated descending aortic dissection patients admitted on the cardiac surgery service
- D. **Clinical Specialty:** Cardiac surgery providers to include physicians, nurse practitioners and physician assistants.

## II. Stakeholder development

- A. **Professionals Involved in Guideline Development:** The Professional Expert Panel participating in the development of this CPG include 1) Zachary Kon, cardiothoracic surgeon; 2) Kristine Russell, senior nurse practitioner; and 3) and Allison Hollis, clinical pharmacist at the medical center. The Doctor of Nursing Practice student developed the initial draft of the CPG that will be evaluated by the Professional Expert Panel.
- B. **Patient's Views and Preferences:** Specific patient views and preferences were not sought for the development of this CPG. The CPG is based on current evidence related to the management of uncomplicated descending thoracic aortic dissections.
- C. **Target Users:** The target users of the CPG will include the nurse practitioners on the cardiac surgery service of a large, academic medical center, as well as all other providers on the service.

### III. Rigour of Development

- A. **Methods:** An extensive search of the literature was performed using the databases of CINAHL, MEDLINE, PubMed, and EBSCOhost utilizing the search terms of “descending aortic dissection,” “uncomplicated descending dissection,” “management of descending aortic dissection,” and “TEVAR.” The current national CPG, Guideline for the Diagnosis and Management of Patients with Thoracic Aortic Disease published by the ACCF and AHA in 2010 and updated in 2013, was reviewed for the development of these focused guidelines. In addition, evidence published since 2013 included randomized controlled trials, nonrandomized trials, and expert clinical opinion were also researched to facilitate an updated review of clinical recommendations. A systematic method was used to search for evidence which included categorizing topics pertinent to the guideline for the management of patients with descending aortic dissection, specifically: 1) background and epidemiology of descending dissection, 2) pharmaceutical, surgical, and medical treatment, and 3) imaging methods for follow-up management.
- B. **Inclusion and Exclusion Criteria:** Inclusion criteria included full text articles published from 2006-2016. The search was limited to articles written in English and included randomized controlled trials, literature reviews, cohort studies, and expert opinions. The target population was the adult patient with uncomplicated descending thoracic aortic dissection, and outcomes measures included all-cause and aortic related mortality related to descending thoracic aortic aneurysm management. Evidence which focused on the management of ascending aortic dissections, ascending or descending aortic aneurysms, and open aortic surgery was excluded in the evidence search. Traditional, open surgery was excluded due to the availability of minimally invasive TEVAR repair in this population.
- C. **Strengths and Limitations of the Evidence:**

1. **Tools:** The strengths and limitations in the body of evidence were graded utilizing the Johns Hopkins Evidence-based Practice Rating Scale to evaluate the strength and quality of each piece of literature of evidence (Newhouse, Dearholt, Poe, Pugh, & White, 2005).
2. **Assessment of Body of Evidence:** Evaluation of the evidence using the Johns Hopkins Evidence-based Practice Rating Scale is based on a grading of the strength and quality of literature. Specifically, the components evaluated include: The evidence design and study objectives, sample size, measurable outcomes, and results of the evidence.
  - a. Measure of the strength of evidence: ranges from Level I to Level V.
    - i. Level I evidence is comprised of randomized controlled trials or meta-analyses of randomized controlled trials, as well as clinical guidelines based on systematic reviews or meta-analyses.
    - ii. Level II evidence is comprised of quasi experimental studies.
    - iii. Level III evidence is comprised of non-experimental study, qualitative study, or meta-synthesis.
    - iv. Level IV evidence was established to be nationally recognized expert opinion based on research or clinical practice guidelines.
    - v. Level V evidence is comprised of opinion of an individual expert based on non-research evidence such as case studies, literature reviews, quality improvement, clinical expertise, or personal experience (Newhouse, Dearholt, Poe, Pugh, & White, 2005).
3. **Measure of the quality of evidence.** Ranges from Levels A, B, or C, according to what type of literature that is being reviewed.
  - i. Level A (high) describes research that has consistent results with an adequate sample size, control, and definitive conclusions. Thoughtful reference to scientific evidence is embodied in this level of research (Newhouse et al., 2005).

- ii. Level B (good) grading is assigned to research evidence with reasonably consistent results and sufficient sample size, as well as reasonably consistent recommendations based on fairly comprehensive literature review (Newhouse et al., 2005).
- iii. Level C (Low) grading is assigned to research with little evidence that has inconsistent results, insufficient sample size, and conclusions that cannot be clearly made. (Newhouse et al., 2005).

**4. Included Evidence:** Thirteen studies were reviewed for this CPG and contained one Level IB, one Level IIA, one Level IIIA, two Level IIIB, four one Level IVB, one Level IIC, and three Level IA articles of research.

**D. Methods Used to Formulate the Recommendations:**

1. **Development:** This CPG was developed by the Doctor of Nursing Practice (DNP) student who is a Nurse Practitioner on a cardiac surgery service that manages patients with descending thoracic aortic dissections. The recommendations provided in this CPG are based upon the current national CPG, Guideline for the Diagnosis and Management of Patients with Thoracic Aortic Disease published by the ACCF and AHA, and an extensive literature search which included an assessment of the strength and quality of the body of evidence.
2. **Process for Evaluation and external review:** The CPG developed by the DNP student will be evaluated by the Professional Expert Panel using The Appraisal of Guidelines for Research & Evaluation (AGREE) II Instrument. This tool assesses guideline quality and methodological rigor used in the CPG development. The use of this tool will provide the Professional Expert Panel an opportunity to make recommendations for improvement to the CPG and tailor the CPG to their specific population and community.

Following the appraisal by the Professional Expert Panel and the inclusion of revisions and amendments to the draft CPG, a finalized version will be presented to the Aortic Director of the medical center as well as Clinical Program Manager for cardiac surgery nurse practitioners and physician assistants for approval.

Lastly, the finalized CPG will be presented to the body of providers on the cardiac surgery service, the end-users of the CPG. The Practitioner Feedback Questionnaire (PFQ) is a tool that can be used by practicing clinicians to assess a CPG. The PFQ consists of 23 items that address scientific quality, methodological rigor, applicability to the population, and the providers' overall acceptability of the CPG. The items are scored on a three-point scale that includes "strongly agree, neither agree or disagree, and strongly disagree." The results of the PFQ provide insight into the end users' intention to use the developed CPG. If revisions to the CPG based on the PFQ are necessary, the Professional Expert Panel will be reconvened to review the changes.

- E. **Health Benefits, Side Effects, and Risks Considered in Formulating the Recommendations** (Please see Section IV)
- F. **Link Between the Recommendations and the Supporting Evidence** (Please see Recommendations, Section IV)
- G. **Guideline updates:** The guideline should be updated every three years or sooner at the requirements or protocols of the facility.

#### IV. **Recommendations for Management**

##### A. **Background: Descending Aortic Dissection Symptoms:**

The most common symptoms and presenting features of descending aortic dissection are chest and/or back pain which comes on abruptly and is sharp, stabbing, or tearing in nature, and radiates to the chest, neck or shoulders. It is important to note that these symptoms are different from angina pain which is usually less abrupt and comes on more gradually (Hiratzka et al., 2010; Erbel et al., 2014; Tsai, Trimarchi, & Nienaber, 2009). According to IRAD data, patients with dissections originating in the descending aorta most commonly complain of back pain (64%) and chest pain (63%). Less commonly, some patients present with abdominal pain (43%) (Hiratzka et al., 2010).

##### **Clinical recommendation:**

- **All patients presenting with high risk features of aortic dissection such as chest and or back pain that have an abrupt onset and is severe with a tearing, ripping or stabbing quality should be evaluated for aortic dissection (Level of evidence: IVA) .**

#### **B. Background: Acuity of dissection**

In addition to anatomical location, dissections also have an acuity classification based on the timing of symptom onset to presentation. The timing of onset was originally classified as: 1) acute, which was designated as under 14 days, or 2) chronic, which was designated as over 14 days from onset of symptoms (Steuer, Bjorck, Mayer, Wanhaien, Pfammatter, & Lachat, 2013). Recent analysis of survival curves shows that mortality increases substantially in the first 30 days from presentation. Therefore, the aorta is still considered unstable during what was identified as the chronic period by the original classification system. This can significantly impact treatment approaches and patient outcomes. Subsequently, researchers and clinicians have recently identified a subacute phase of dissection to describe the period of time between two weeks and 60 days from the onset of aortic dissection (Steuer, et al., 2013).

#### **Clinical recommendation:**

- **Providers should classify the subacute period after dissection as two weeks to 60 days and recognize the aorta is unstable and susceptible to aortic expansion or rupture during that period (Level of evidence: IVB).**

#### **C. Background: Complicated versus Uncomplicated dissection.**

Descending aortic dissections are classified as either complicated or uncomplicated. Complicated dissections account for 15-20% of all descending aortic dissections and occur when the patient exhibits any signs of organ

malperfusion, rupture or impending rupture, persistent pain, or refractory hypertension not responsive to medical therapy. These patients most often receive emergency thoracic endovascular aortic stent repair (TEVAR) while uncomplicated descending aortic dissections (patients without the above symptoms) are initially managed medically. (Hughes, Anderson, & McCann, 2013). There is also data that shows that patients with refractory hypertension or pain who are medically managed are at a significantly higher in-hospital mortality risk, than those patients without these symptoms or who were managed with stent grafting or surgery (Trimarchi, Eagle, Nienaber, Pyeritz, Jonker, Suzuki, Isselbacher, 2010).

**Clinical recommendations:**

- **During the initial presentation to the hospital when identification of an aortic dissection is made, all patients should receive a surgical evaluation and risk stratification with a surgeon on the cardiac surgery service. Uncomplicated descending aortic dissection patients should be initially treated medically with focus on heart rate and blood pressure control, as well as pain control (Level of evidence: IVA).**
- **Descending aortic dissection are considered complicated when signs of organ malperfusion, rupture or impending rupture, persistent pain, or refractory hypertension are present. These patients should be referred for urgent or immediate surgery (Level of evidence: IVB).**
- **Uncomplicated aortic dissections are those without any signs of organ malperfusion, rupture or pending rupture (Level of evidence: IVB).**
- **Patients with persistent pain or hypertension are at an increased risk of aortic rupture and therefore should be placed into a high risk category (Level of evidence: IVB).**

**D. Background: Risk factors.**

Patients with significant risk factors of aortic disease in their past medical history such as aortic aneurysm, a family history of aortic dissection or sudden death, connective tissue disorders, smoking history, or hypertension, should be evaluated for aortic dissection if presenting with symptoms of abrupt chest or back pain (Hiratzka et al., 2010). A significant number of patients who present with dissection have uncontrolled hypertension. (Hiratzka et al., 2010).

**Clinical recommendations:**

- **Patients with a history of aortic aneurysm, family history of aortic dissection or sudden death, connective tissue disorders, smoking, or hypertension who present with an abrupt onset of chest or pain back should be evaluated for aortic dissection (Level of evidence: IA).**

**E. Initial Diagnostic Testing and Imaging modalities**

All patients presenting with symptoms consistent with aortic dissection should have urgent and definitive imaging of the aorta using transesophageal echocardiogram (TEE), computed tomographic imaging (CT) scan with contrast, or magnetic resonance imaging (MRI) (Hiratzka et al. 2013).

1. Transesophageal echocardiogram (TEE): Transesophageal echocardiogram is used to accurately identify the precise location of intimal flaps, specifically in the proximal ascending aorta, measure pressure gradients across the true and false lumen, and assess the thrombosis of the false lumen in the dissection (Erbel et al., 2014). The sensitivity of the TEE is noted by Erbel et al., (2014) to be 99% with a specificity of 89%.

2. Computed tomographic imaging with contrast: In suspected aortic dissection, CT with IV contrast is the preferred method of imaging given it is fast and readily accessible. Imaging with contrast is performed using a timed bolus to ensure opacification of the aorta (Liotta, Chughtai, and Agarwal, 2012; Hiratzka et al, 2010).
3. Multidetector computed tomography: Hiratzka et al. (2013) and Liotta et al., (2012) recommend the use of multidetector computed tomography angiography with intravenous contrast (MDCTA)
4. Magnetic resonance imaging: Utilization of MRI with contrast is a great method of diagnosing aortic dissection due to visualization of the distal aortic arch and accurate view of entry and reentry tear with sensitivity and specificity of 98% (Hiratzka et al., 2010). However, limitations with availability and use in critical patients prevent its routine use as a first line imaging method. MRI has also been noted to be very helpful in detecting the presence of pericardial effusions, aortic regurgitation, or carotid artery dissection (Hiratzka et al., 2010).

**Clinical recommendations:**

- **Patients who present with symptoms consistent with aortic dissection should undergo an urgent Chest CT with IV contrast (Level IVA).**
- **Given the quickness of the study and high availability across centers, a contrasted CT scan is the most commonly used first line imaging modality to evaluate for dissection, however MRI or TEE can also be used (Level of evidence: IVA).**
- **Alternatively, if patients have a history of renal insufficiency or allergy to contrast dye, MRI should be utilized at the discretion of the facility (Level IVA).**

**F. Medical Management**

1. Heart rate and blood pressure control: The goal of heart rate and blood pressure control is centered around the reduction of aortic wall stress by maintaining a lower heart rate and blood pressure by means of various pharmaceutical agents (Hiratzka et al., 2010). Aortic wall stress is impacted by velocity and rate of ventricular contraction as well as blood pressure (Hiratzka et al., 2010). Patients should be maintained with a heart rate of 60 beats per minute and systolic blood pressure under 120 mmHg. The various agents used to achieve these markers include the use of beta blockers, calcium channel blockers, central vasodilators, angiotensin converting enzyme inhibitors, and angiotensin renin blockers.

**Clinical recommendation:**

- **Initial management of aortic dissection should be aimed at reducing aortic wall stress by controlling heart rate and blood pressure. Patients should be maintained with a heart rate of 60 beats per minute and blood pressure under 120 mmHg systolic (Level of evidence: IVA).**

2. Pharmaceutical agents

- A. Beta blockers: Beta blockers should be used as first line agents to achieve a target heart rate of 60 and systolic blood pressure under 120 mmHg while ensuring end organ perfusion. Intravenous agents such as labetalol or esmolol should be utilized in initial management.
- B. Calcium channel blockers: If beta blockade is contraindicated, nondihydropyridine calcium channel blockers such as verapamil or diltiazem can be used to achieve blood pressure and heart rate target goals (Hiratzka et al., 2010). A univariate analysis of antihypertensive medications used in acute aortic dissection

supported the use of beta blockers to improve five-year survival rates ( $p=0.02$ ) (Suzuki et al., 2012). This analysis also revealed that calcium channel blockers which aid in aortic remodeling were associated with improved five-year survival rates for medically managed descending aortic dissections ( $p=0.03$ ) (Suzuki et al., 2012). It is recommended that beta blockers and calcium channel blockers be initiated in the regimen of patients with descending aortic dissection.

- C. Central vasodilators: Often, additional agents are required in order to achieve target blood pressure and heart rate goals. Central vasodilators such as nitroprusside and nitroglycerin can be added to provide antihypertensive control (Hiratzka et al., 2010).
- D. Angiotensin converting enzyme inhibitors and angiotensin II receptor blockers: Angiotensin converting enzyme inhibitors (ACEI) and angiotensin II receptor blockers (ARB) such as lisinopril, enalapril, valsartan, and losartan are additional oral agents that could be used with this patient population to achieve target blood pressure and heart rate goals. In a univariate analysis of drug class with mortality in aortic dissection, the study did not find either drug class to have an impact on mortality, however, could be used for adjunct therapy in maintaining target hemodynamics (Suzuki et al., 2012).

**Clinical recommendation:**

- **Intravenous beta blockers such as esmolol or labetalol should be used as first line agents to achieve a heart rate under 60 beats per minute and a systolic blood pressure under 120 mmHg except in cases where evidence of organ malperfusion is present at the discretion of the physician (Level of evidence: IIB).**

- **If beta blockade is contraindicated, calcium channel blockers such as verapamil or diltiazem should be used to achieve a heart rate under 60 beats per minute and a systolic blood pressure under 120 mmHg (Level of evidence: IIIB).**
- **If additional agents are required to maintain target goals of a heart rate under 60 beats per minute and a systolic blood pressure under 120 mmHg, angiotensin converting enzyme inhibitor or angiotensin II receptor blockers can be used. Vasodilators such as sodium nitroprusside or nitroglycerin may also be used intravenously to provide hypertensive control (Level of evidence: IIIB).**
- **In addition, all patients will be referred to an internist who specializes in hypertension. If a patient already is under the care of a provider for their hypertension, the provider name will be documented so that clinical correspondence can occur between providers.  
(Recommendations for surgical repair in the acute phase is outside the scope of this guideline)**
- **After initial stabilization of the patient with intravenous agents and clearance of oral intake, the patient should be started on oral medications for long term management (Level of evidence: IA).**

**G. Follow-up with surveillance imaging:** All patients who are diagnosed with descending aortic dissection should have a follow-up consultation with a surgeon along with a CT scan or MRI to perform surveillance imaging at discharge as well as at specific intervals of time such as one, three, six, and 12 months after discharge to evaluate for any aneurysmal change or enlargement of the dissection (Hiratzka et al., 2010). It is important to maintain consistency in modality of imaging so that the imaging can be compared equally over a timespan (Hiratzka et al.,

2010). The surveillance imaging should coincide with an office appointment with their surgeon to assess how the patient is progressing clinically.

**Clinical recommendation:**

- **Patients who are admitted and diagnosed with a descending aortic dissection will be discharged after achievement of goal hemodynamics on oral therapy for 24 hours. An appointment with a surgeon will be made within three to four weeks from presentation and will include a contrasted CT scan or MRI (Level of evidence: IA).**
- **Surveillance imaging by method of contrasted CT or MRI should be performed prior to discharge and at one, three, six, and 12 months from presentation to the hospital (Level of evidence: IA).**
- **Regardless of what method of imaging is performed, the modality should remain consistent so that comparisons can be made among the studies (Level of evidence: IA).**

**H. Surgical risk stratifying for high risk patients for elective surgical repair**

**Thoracic endovascular aortic repair (TEVAR):** Thoracic endovascular aortic repair (TEVAR) is an endovascular approach to repair aortic dissection. The procedure originated in the 1990s and has been attributed to decreasing mortality of aortic dissection (Nauta et al., 2016). The aim of using TEVAR is to discontinue blood flow into the false lumen of the aorta by covering the primary entry tear and restoring blood flow into the true lumen (Nauta et al., 2016). Until recent trials, TEVAR was used primarily with complicated aortic dissections only. Considering that the initial management of uncomplicated descending aortic dissection is medical management, routine aortic repair in these patients who have been deemed stable is not yet strongly indicated. However, recent evidence is showing

improved long term survival when patients undergo TEVAR even when they show no signs of complicated dissection.

The Acute Dissection Stent Grafting or Best Medical Treatment (ADSORB) trial was the first prospective randomized controlled trial (RCT) which compared best medical therapy (BMT) and endoluminal stent graft (TAG) with BMT alone in uncomplicated descending aortic dissections (Brunkwall et al., 2012). Results showed a significant occurrence of incomplete false lumen thrombosis in 97% of the participants in the BMT group. The BMT and TAG participants had a true lumen size increase along with a false lumen size decrease compared to the BMT only group, which were noted to have no change in the true lumen size with an increase in the false lumen size.

The Investigation of Stent Grafts in Aortic Dissection (INSTEAD) trial was a prospective randomized controlled trial evaluating two year outcomes for patients treated with TEVAR plus medical therapy versus medical therapy alone (Niemaber, 2011; Hughes et al., 2013). The results revealed that aortic remodeling occurred at a rate of 91% of the participants in the TEVAR and medical treatment group compared to 19% in the medical treatment alone group. This same group of investigators retrospectively evaluated long term data on the same cohort of patients in a retrospective randomized clinical trial entitled, Endovascular Repair of Type B Aortic Dissection: Long-Term Results of the Randomized Investigation of Stent Grafts in Aortic Dissection Trial (INSTEAD-XL) (Niemaber, et al., 2013). The participants were followed for a minimum of five and maximum of eight years. Survival curves revealed that the TEVAR and medical treatment group demonstrated an improved survival benefit (100%) compared to the medical treatment alone group (83%). False lumen thrombosis at five years was seen in 90% of participants along with evidence of aortic remodeling in 79% of the TEVAR and medical treatment group. The medical treatment only group demonstrated an aortic diameter enlargement from 43 to 56 mm, with rare aortic remodeling (Niemaber et al., 2013). These findings demonstrate that TEVAR in the subacute phase of aortic

dissection induces false lumen thrombosis with aortic remodeling and reduces aortic related mortality at over five years from initial presentation.

According to Qin, Wang, Li, Ding, Deng, Xie, and Teng (2016), medical therapy alone without TEVAR carries a 30-50% risk of mortality five years from the onset of the dissection. This data supports the fact that while medical therapy alone is adequate treatment in the acute setting from presentation to discharge (90% survival), mortality rates decrease with the use of TEVAR and medical therapy for improved long term survival.

- 1. High risk patients for late aortic degeneration:** There are certain characteristics or features in uncomplicated aortic dissection patients who are identified as having a high risk of developing early or late aortic changes. Some of these factors include an initial aortic diameter over four centimeters with a patent false lumen, refractory pain or hypertension, an initial large false lumen over 2.2 centimeters, or intramural hematoma with development of a penetrating ulcer in the proximal portion of the descending aorta (Trimarchi et al., 2010; Song, Kim, Kim, Kim, Kang, Seo, ... Song et al., 2007).
- 2. Timing to perform TEVAR:** There is limited evidence to support TEVAR in the acute phase of uncomplicated dissections, and additional research is needed to strongly support the use of TEVAR in the subacute phase. However, recent research is revealing improved long term outcomes with patients who receive TEVAR due to false lumen thrombosis and aortic remodeling, which should be beneficial, especially in high risk patients (Nienaber, 2013; Trimarchi et al., 2010; Song et al., 2007). Unfortunately, there is a lack of strong evidence to guide providers as to the appropriate timeframe to intervene surgically.

- 3. Follow-up of patients who have undergone TEVAR:** Patients who undergo TEVAR should follow the same regimen of follow-up imaging prior to repair. Patients should receive a CT scan or MRI prior to discharge from the hospital, one, three, six, and 12 months from repair. Imaging at the time of discharge is especially important once TEVAR has been performed to evaluate for any evidence of endoleak (Hiratzka et al., 2010).

**Clinical recommendation:**

- **Patients with uncomplicated descending aortic dissection should be managed with medical therapy initially with the plan to consider TEVAR if the patient shows any findings of aortic degeneration (Level of evidence: IVB).**
- **Patients that are high risk of developing late aortic changes such as initial aortic diameter over four centimeters with a patent false lumen, refractory pain or hypertension, an initial large false lumen over 22 millimeters or intramural hematoma with development of a penetrating ulcer in the proximal portion of the descending aorta, should be seen in the surgeon's office within three weeks from hospital presentation to be considered for TEVAR procedure (Level of evidence: IVB).**
- **Patients who receive TEVAR should have a contrasted CT or MRI prior to discharge, one, three, six, and 12 months from the procedure to evaluate for endoleak and aortic integrity (Level of evidence: IVA).**

**I. Health Benefits, Side effects, and Risks**

The health benefits that the target patient population can acquire include a reduced risk of mortality due to a systemic decrease in blood pressure and heart rate, reduction in risk of aortic rupture due to reduced occurrence of aneurysmal enlargement of descending dissection, and overall improved mortality both in an all cause manner as

well as aortic specific (Hiratzka et al., 2010). Side effects of utilizing the CPG mainly are associated with the pharmaceutical choices in management of the patients. Complications related to an unknown drug allergy could occur.

Tobacco abuse, namely cigarette smoking, has shown to have a positive correlation with aneurysmal growth in patients with aortic dissections or aneurysms (Hiratzka et al., 2010). Therefore, smoking cessation is an imperative patient education factor that should be included in the follow-up management.

As noted in the literature, improved long term outcomes were noted in patients who received TEVAR plus medical therapy as opposed to medical therapy alone, with a 90% rate of false lumen thrombosis rate in these patients. There is a positive correlation between reduction of mortality with increased rate of false lumen thrombosis (Brunkwall, Kasprzak, Verhoeven, & Heijman, 2014; Nienaber, 2011; Nienaber et al., 2013).

## **V. Implementation and applicability**

**A. Facilitators and Barriers:** The implementation of this guideline is intended for use on uncomplicated descending aortic dissection patients on the cardiac surgery at the target facility. Facilitators of the implementation are the specialized care these patients receive on the cardiac surgery service as well as the support of the surgeons who would be implementing the guideline on their own patients. The barriers to the guideline include the common problem of follow-up for these patients. Compliance with medical therapy is also a continuous concern. The patients are often referred to physicians or clinics, but often do not actually make it to the office appointment for mostly external factors, but sometimes internal factors such as errors in scheduling or poor infrastructure to handle the influx of patients. The patients will be discharged with their appointments already scheduled for them, and those appointments will be visible on their discharge paperwork which eliminates the additional step of scheduling for the patients.

- B. Recommendations for Implementation:** A resource sheet with the summary of recommendations will be provided to the clinical staff so that the key points of the guideline are easily viewable and readily assessable when the patient is admitted and undergoing workup and evaluation.
- C. Potential Resource Implications:** The patients with descending dissection at the target facility are mostly cared for on the cardiac surgical service. Therefore, by streamlining their care and management by means of this guideline, no additional resources should need to be provided for its' success and implementation.
- D. Monitoring and Auditing Criteria:** The target patients will be receiving continuous monitoring by means of regularly scheduled surveillance imaging and office appointments as outlined in the management recommendations. The focused office visit will include aortic imaging to provide exact measurements of the aorta, continued education regarding hypertension management and smoking cessation. In addition to these factors, the progress of each patient will be evaluated individually by the surgeon during the visit including vital signs and compliance of medical therapy with heart rate goals of 60 beats a minute and blood pressure under 120 mmHg systolic.

## **VI. Editorial Independence**

- A. Funding Body:** This CPG was developed without external funding and as part of a DNP project. All involved in the CPG have confirmed that they have no competing interests.
- B. Principal Author:** Lauren Nawrocki, MS, CRNP (DNP student)

**C. Key Contributors:** Zachary Kon MD, Kristine Russell CRNP, Allison Harris PharmD; Dr. Fran Valle (Project Team Leader); Dr. Carmel McComiskey, Project Team Member)

**D. Date to be released:** 7/10/17

## Appendix K

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