Pregnancy with Aortic Aneurysm; A Retrospective Cross-sectional Study at King Salman Bin Abdulaziz Medical City

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ABSTRACT

Aortic aneurysms in pregnancy are catastrophic rare condition with high maternal and foetal fatality, with increased risk for aortic dissection especially during third trimester and peripartum period. Management requires multidisciplinary team to control the risk. Proper decisions when dealing with such cases include screening for dissection, proper timing for surgical management, proper time and mode for delivery, postpartum care, and future contraception. This is a retrospective cross-sectional study reviewed files of pregnant women diagnosed with aortic aneurysm. KSAMC from 2000 to 2023. The study was conducted from 2000 and 2023 to estimate the prevalence of aortic aneurysm in pregnant woman during the past 23 years. Only one patient with multiple aortic aneurisms was recorded who was primigravida with chronic hypertensive, multiple aortic aneurysms and acute DVT. Patient had LSCS and discharged with her baby in good condition. Prompt identification, counselling, and risk reduction strategies may help optimizing the outcomes for such cases.

Keywords: Aortic aneurysm, Dissection, Pregnancy, Imaging, Hypertension, IUGR.

INTRODUCTION

Aorta is the largest artery in the body, consists of five sections which are the root, the ascending thoracic aorta, arch, descending thoracic aorta and lastly the abdominal aorta[1]. The aortic wall consists of three layers; a thin layer of endothelial cells called intima, a thick central smooth muscle cells, elastic fibres, collagen proteins, and polysaccharides media and a thin outer adventitia (Figure 1)[1,2].

One of the diseases that affect the arteries of the body is aneurysm. An aneurysm is defined as dilatation of the artery more than 1 1/2 times its original diameter[1-3]. Applying this rule on the aorta, for example, if we looked at the root of the aorta the normal diameter in an adult is about 3.5 centimetres and to have aneurysm of the root of the aorta then it should be at least 5.25 centimetre in diameter[1,4].

Aortic aneurysm affects 5 to 10 per 100,000 persons globally[5,6]. In 1996 Al-Zahrani et al, described the prevalence of aortic aneurysm in Saudi Arabia as 1.9% but this description was only applied to 60 to 80 years old adults[7]. Since this study in 1996 there was no new studies on the prevalence of aortic aneurism in Saudi Arabia.

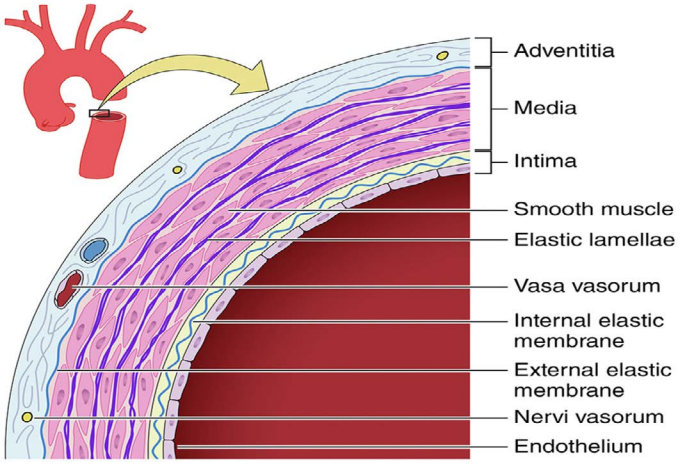

Figure 1. Diagram illustrating the Aortic Wall (adapted from figure 20.3 in BC OpenStax Anatomy and Physiology used under CC-BY 4.0.)

Incidence of aneurysm in the ascending aorta is almost double the incidence in the thoracic descending and abdominal aorta [8]. The most important risk

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Table 1. Risk factors for aortic aneurysm

Strong Risk Factors	Additional Risk Factors
Smoking history	Hypertension
Older age	Hyperlipidaemia
Male sex	White race
Family history of abdominal aortic aneurysm	Inherited vascular connective tissue disorder
	Atherosclerotic cardiovascular disease

factors for developing aortic aneurysm are smoking, hypertension, hypercholesterolemia and genetic predisposition (Table 1)[1,2].

Acute aortic aneurysm if untreated or undiscovered fast well result in threatening complications and may end in fatality in 1 to 2% of cases[2,9]. The diagnoses of aortic aneurysm may be challenging especially that the symptoms of the aneurysm resemble many common emergency complaints. Classical complaint usually is tarring or ripping pain. Others may complain of sharp chest pain. Usually, the pain starts very sharp and then it starts to radiate to the sides of the chest sometimes to the sides of the abdomen[2,10-12].

Pregnancy consists of many Haemodynamic and hormonal changes that affect all aspects of woman's live. These changes in case of the presence of aortic aneurysm considered a risk factor for aggravating the disease or putting the patient in a very high risk[4,9,13]. Acute aortic aneurysm or aortic dissection on top of aneurysm in pregnancy is rare, it affects only 0.0004% of pregnancies[3,10]. Risk during pregnancy consists of having aortic dissection on top of the aneurysm throughout pregnancy or up to 12 weeks postpartum[1,2,13].

The recommendation of NICE and American college of cardiologists for any woman at risk of aortic aneurysm or known case of aortic aneurysm to undergo radiological measurement of the aorta pre-pregnancy and to have counselling discussion. These measures should be repeated several weeks postpartum to monitor aortic changes[1,2]. Women with aortic aneurysm are advised to avoid pregnancy and undergo aortic aneurysm surgery before conception[3,9,14]. Counselling and management of women should be done through a multidisciplinary team involving a cardiologist, a cardiothoracic surgeon, an anaesthetist with an experienced obstetrician and Paediatrician. This team can clarify and manage cardiovascular conditions associated with pregnancy. Worries and consequences of aortic aneurysm should be discussed with the patient on an individual basis. The decision to prevent pregnancy should be allowed in view of the aneurysm and expected complications[6,9,15]. After all, Frequently women with aortic aneurysm are not recognized before pregnancy[12,16].

Metabolic demands of the foetus, placenta, and uterus during pregnancy causes huge physiological changes in the cardiovascular system. This is mainly due to the increasing levels of pregnancy hormones[1]. Physiologically, maternal blood volume increases progressively from first trimester and reaches a maximum at 32–34 weeks. Similarly, plasma volume increases 40–50%, while red cell mass increase 20–30%. All this means a steady increase in cardiac output. This is expected with rapid heart rate (15%), increase in stroke volume (35%) and reduction in systemic vascular resistance[1,5,9,14]. These physiological changes impact aortic wall during pregnancy[1,9].

Similarly, there is a risk of radiation exposure during pregnancy. the International Commission on Radiological Protection (ICRP) announced that, diagnostic radiological examinations radiation may not have any bad effects on the baby, but radiation-induced effect cannot be entirely ruled out[14,17]. Aortic imaging frequency during pregnancy is advised to be performed once every trimester and several weeks postpartum[5,17,18].

Hypertension is a major risk factor during pregnancy for aortic dissection on top of aneurysm. In those patients beta blockers throughout pregnancy and postpartum periods is advised such as Labetalol[9,11].

Pregnancy surgical treatment is restricted for lethal complications otherwise, it may subject the foetus to death or neurological injury. With ruptured maternal aneurysm death ranges from 65 to 85%. Aneurysm surgery during pregnancy is indicated between 13- and 28-weeks' gestation, under full maternal and fetal monitoring[3]. Vaginal delivery of low-risk women helps decrease the hemodynamic stress and shorten second stage of labour. On the other hand, high risk patients should undergo caesarean delivery[1-3]. If dissection on top of aneurysm occur during the first two trimesters, emergency aortic surgery is performed first with foetal monitoring, modifications to anaesthesia and cardiopulmonary bypass.

If it occurs between 24 and 28 weeks, doctors should decide between caesarean delivery followed by aortic surgery or aortic surgery with foetal surveillance. On the other hand, if it occurs in the third trimester, emergency caesarean delivery followed by maternal aortic surgery is recommended[3,19]. Babies of mothers suffering from aortic aneurysm usually delivered suffering from chronic intrauterine growth retardation (IUGR), smaller in size and weight. This is mainly because of the long use of beta blockers throughout the pregnancy and also may be due to the affection of blood supply of the uterus with the aneurysm[10,14].
This research aims to investigate the prevalence of aortic aneurysm with pregnancy in King Salman bin Abdulaziz Medical City (KSAMC) for the past 23 years. On top of that, describe presentation and management of those patients.

METHODOLOGY

Study design and study setting: This is a cross-sectional study conducted between first of January 2000 and end of December 2023. In The current study files of pregnant women having aortic aneurysm attending King Salman Bin Abdulaziz Medical City (KSAMC), Obstetrics and Gynaecology department in the period between January 2020 to December 2023 were reviewed. This file review take place in the Medical Record department. Inclusion criteria were all pregnant woman diagnosed with aortic aneurysm before or during pregnancy attending the Obstetrics and Gynaecology department, KSAMC for any reason from 2000 to 2023. Records of all patients satisfy previous condition were included in the study and therefore no sample size calculation needed

Variables: The retrieved data included the following variables: demographic data of the participants (Age, nationality, education, Gravidity and parity), number of visits, type of aneurysm, when was diagnosed, symptoms and signs, management of the participant, any complications, mode of delivery, neonatal APGAR score at 5 minutes, admission to NICU, any neonatal complications and neonatal deaths.
Ethical practices ensured by protecting patients' privacy and confidentiality through avoiding direct patient identification. The data was stored in a password-protected computer that is accessible only to principal.

Statistical analysis: Data managed and analysed using Statistical Package for Social Sciences version 28 (SPSS 28)[20], the P-value is considered statistically significant when it is less than or equal to 0.05. For continuous variables, a student t-test was planned to be used to evaluate differences in means between the groups. For

categorical data, a chi-square test was planned to be used to assess differences in proportions across the categories. Descriptive statistics is used whenever possible. These including quantitative variables summarization as Mean and Standard Deviation. While qualitative variables to be calculated using frequency and percentage.

RESULTS

Estimated disease frequency of aortic aneurysm:

There were 410355 deliveries between first of January 2000 until the end of December 2023. Only one patient was identified as aortic aneurysm with pregnancy during late 2023. This makes the prevalence of aortic aneurysm occurring during pregnancy in KSAMC is 1/410355, in other words 0.0002%. Alternatively, the incidence in KSAMC is 2/1,000,000 pregnancy per year.

Demographic and medical data

This only patient was a 34-year-old-woman, married for one year and she is a primigravida. She is Obese patient (BMI 34.2), known chronic hypertensive on Aldomet once daily and known patient of multiple aortic aneurysms which were operated 12 years ago (Juxta-renal abdominal aortic aneurysm, bilateral common iliac aneurysm and thoracic aortic aneurysm). She is 35 weeks pregnant with acute DVT (left lower limp) on high therapeutic dose of Clexan and aspirin.

Data about management plan

Patient was vitally stable but radial pulse is weaker in left arm compared to right arm. No bruit is heard over carotid or subclavian artery. Foetal movement positive and CTG reactive (Figure 2). On ultrasound scan, baby is 34 weeks breech Expected foetal weight 2259 grams, Amniotic fluid index 12cm and placenta posterior upper. All her investigations were normal except mild microcytic hypochromic anaemia.

Special high-risk committee was gathered to plan the management of this patient. Committee included senior consultant Obstetrician, consultant Anaesthetist, consultant Vascular surgeon, consultant Medicine and consultant paediatrician. The decision was taken to perform lower segment caesarean section (LSCS) after completing Dexamethasone doses (for baby lung maturation). Within two days LSCS done and patient delivered a boy 2.4 Kg's a life and well with APGAR score of 7 at 1 minute and 8 at 5 minutes. Patient course in the hospital post operative was uneventful and she was discharged after 7 days post operative in good conditions.

DISCUSSION

This research only found one single patient during the last 23 years that suffered multiple aortic aneurisms. Fortunately, this patient and her baby survived this audial. The incidence of aortic aneurysm during pregnancy globally is 1 case per 250 thousand pregnancies[3,10]. Compared to the incidence in KSAMC where it is 1 case per 500 thousand pregnancies. This difference in incidence is important for health authorities to plan for future resources and research in this area.

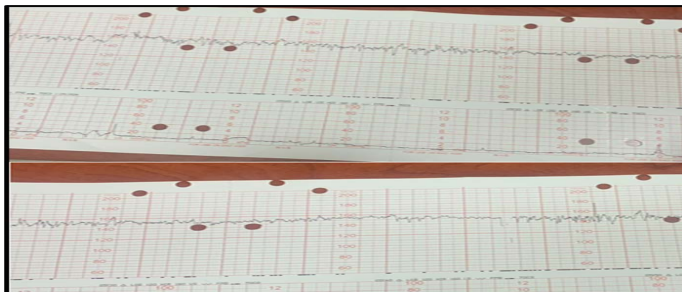

Figure 2. Patient's CTG

Pregnancy with aortic aneurysm increases the hazard of foetal and maternal injury and death. The precise prevalence and incidence of pregnancy with aortic aneurysm is not established yet. This is because in literature reported cases are either with massive complications or with impressive repair[5]. More importantly, Aortic aneurysm is associated with many genetic and non-genetic factors. Genetic component includes Marfan's syndrome, Turner syndrome or Ehler Danlos syndrome[7,8,21]. Similarly, non-genetic risk factors include hypertension and smoking[18,21]. In addition, third trimester pregnancy is a risk factor for aneurysm complications[11,21].

Counselling and management of pregnancy with aortic aneurysm patients by a multidisciplinary team is crucial to manage the cardiovascular complications during pregnancy[1,3]. Any worries of aneurism complications must be explained to the patient on case-by-case basses to prevent pregnancy[3]. Similarly, pregnant women with aortic aneurysm need to be checked further depending on patient condition[5]. In all cases, rigorous and numerous follow-ups prevail as the anchor for prevention, early diagnosis and safe management of pregnancy with aortic aneurysm.

CONCLUSION

Hypertension with the presence of aortic aneurysm during pregnancy increased overall risk of complications. Consequently, proper identification, counselling, and risk reduction strategies may help optimizing the outcomes for the woman and her offspring.

Authorship Contribution: Rehab Alruwathi participated in designing the study, conducting the literature search, obtaining authorization to use the data, selecting the study tools and managing the data. Homoud Al-Rajeh was responsible for analysing the statistical data, interpreting the data, and writing the manuscript. Basil Othman, participated in the design and selection of the study tools, interpretation of the data and the writing of the manuscript. Mohammad Othman participated in the interpretation and analysing the data and drafting of the manuscript. All authors critically reviewed the manuscript and approved the final version for submission.

Potential Conflicts of Interest: None

Competing Interest: None

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