

Full Length Research Paper

Endovascular and conventional surgical treatment of aneurysms of the aorta and its main branches in Sub-Saharan Africa: The experience of the Côte d'Ivoire

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Received 17 September, 2022; Accepted 10 February, 2023

The objective of this retrospective descriptive study is to share the experience of the Abidjan Heart Institute in the global management of aneurysms of aorta and its main branches from January 2007 to February 2022. It focused on the medical records of patients operated on for an aneurysm of the aorta and its main branches at the Abidjan Heart Institute. The following parameters were studied: Age, sex, circumstances of discovery, degree of urgency, anatomical-clinical characteristics thanks to CT angiography, approaches, operative techniques, duration of interventions, duration of stay in intensive care and in hospital, immediate, short and medium term post-operative results. Thirty seven medical records were collected. Twenty-nine (78.4%) patients were male and eight (21.6%) were female. The average age of the patients was 52.36 years. The circumstances of discovery were represented by clinical signs in 56.8%, while 29.7% were incidental findings, and by complications in 13.5%. CT angiography revealed 48.7% of aneurysms located in the sub-renal abdominal aorta, 10.8% of aneurysms located in the aorto-biiliac portion, 10.8% of the aneurysms were located on the common iliac arteries, 8.1% on the ascending aorta, 18.9% on the descending thoracic aorta and 02.7% on the left renal artery on a single kidney. The saccular anatomical type was observed in 32.4% and the fusiform type in 67.6%. Conventional surgery was performed in 75.7% and the endovascular procedure in 24.3%. These two complementary methods have considerably improved the management of patients with aortic aneurysms in Côte d'Ivoire in recent years.

Key words: Aneurysms of aorta and its main branches, conventional surgery, endovascular procedure.

INTRODUCTION

Aneurysms, together with dissections, are the main pathologies of the aorta, with a high risk of acute and

potentially fatal complications (Robert et al., 2015). Aneurysm is a localized dilatation of a more or less long

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Table 1. Clinical presentation of patients with aneurysms.

Circumstances of discovery	Number	Percentage
Clinical signs	21	57.8
Incidental discovery	11	29.7
Complications	5	13.5
Total	37	100

Table 2. Aneurysm locations.

Locations	Number	Percentage
Sub-renal abdominal aorta	18	48.7
Aorto-bi-iliac	4	10.8
Common iliac artery	4	10.8
Left renal artery on single kidney	1	02.7
Ascending aorta	3	08.1
Descending thoracic aorta	7	18.9
Total	37	100

segment of the aorta with loss of parallelism of its edges (Fabiani and Saliou, 1997). Conventional surgery was considered as the reference treatment (Mujagic et al., 2013). But since 1991 the therapeutic management of aortic aneurysms has been enriched, by the advent of endovascular procedures as an alternative to conventional surgical treatment (Mujagic et al., 2013; Farhat et al., 2020).

Several patients were managed surgically at the Abidjan Heart Institute using the conventional technique. However, some aneurysm locations left the surgical team at a loss as they were managed by endovascular procedures; endovascular procedures are not possible in our center before 2016. Medical evacuation abroad was the only acceptable recourse for patients who could afford it. Since 2016, the Abidjan Heart Institute has been equipped with a hybrid room, making endovascular procedures possible in Côte d'Ivoire. However, stents are custom-made by foreign laboratories, particularly in Western countries. A partnership agreement was therefore signed in 2019 with a vascular surgeon from a French hospital with the aim of supporting the local surgical team in mastering these endovascular procedures.

The aim of this study was to share the experience of the Abidjan Heart Institute in the global management of aneurysms of aorta and its main branches.

MATERIALS AND METHODS

This is a retrospective descriptive study covering the period of January 2007 to February 2022, based on the medical records of patients operated on for aneurysms of the aorta and its main branches in the Cardiovascular Surgery Department of the Abidjan

Heart Institute. Patients whose records could not be found or were incomplete were not included in the study. The following parameters were studied: age, sex, clinical presentation, degree of urgency, anatomic-clinical characteristics with angioTomodensitometry, approaches, therapeutic modalities, duration of intervention, duration of stay in intensive care and in hospital, immediate and short- and medium-term post-operative results.

RESULTS

Thirty-seven medical records were collected. Twenty-nine patients were males and eight were females. The mean age of the patients was 52.36 years (range 22-78 years). The circumstances of discovery are listed in Table 1.

These clinical signs were abdominal pain and/or perception of an abdominal mass (n=21). Aneurysmal rupture with internal haemorrhagic shock (n=4) and acute ischemia of the lower limb (n=1) were the complications.

The aneurysms and their locations were identified by AngioTomodensitometry (Table 2). The saccular anatomical type was observed in 32.4% (n=12) and the fusiform type in 67.6% (n=25) (Figure 1). The treatment modalities are illustrated in Figure 2. Elective operation was performed in 86.5% (n= 32) while emergency surgery was performed in 13.5% (n=5). The different approaches are listed in Table 3.

Supra-renal clamping was required in 3 of the 8 retroperitoneal approaches. Postero-lateral thoracotomy was performed in 1 case of ruptured aneurysm of the descending thoracic aorta.

Bentall surgery was performed in 10.7% (n=3) patients with ascending aortic aneurysms. The flattening-prosthetic graft was performed in 89.3% (n=25) patients

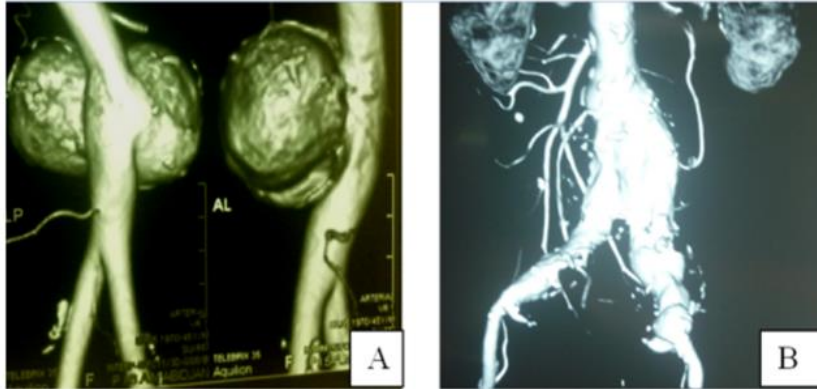


Figure 1. Abdominal angiotomodensitometry showing anatomical types of aneurysm of aorta: (a) saccular types and (b) fusiform type.

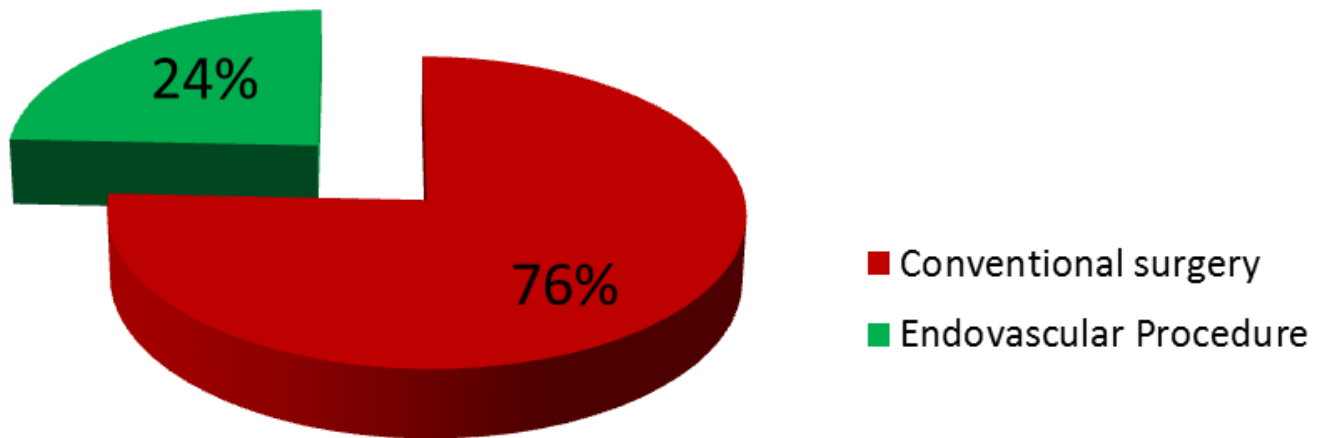


Figure 2. Therapeutic modalities.

Table 3. Aneurysm approaches.

Aneurysm approaches	Number	Percentage
Vertical median laparotomy	16	43.3
Retroperitoneal approach	8	21.6
Postero-lateral thoracotomy	1	02.7
Vertical median sternotomy	3	08.1
Surgical approach to the common femoral artery in Scarpa's triangle	9	24.3
Total	37	100

(Figure 3). The covered endovascular stent-graft procedures involved 06 cases of aneurysms of the descending thoracic aorta (Figure 4) and 03 cases of aneurysms of the sub-renal aorto-bi-iliac portion. All stents were successfully deployed without the need for conversion to conventional surgery.

Conventional surgical procedures had a mean duration

of 3 h 40 min (Range 3 h 03 min – 6 h 23 min). Endovascular procedures had a mean duration of 40 min (Range 30-60 min). The average length of stay in intensive care after conventional surgery was 02 days 08 h (Range 19 h - 5 days) and the average length of postoperative hospitalization was 8 days (Range 4-21 days). The average length of stay in intensive care after

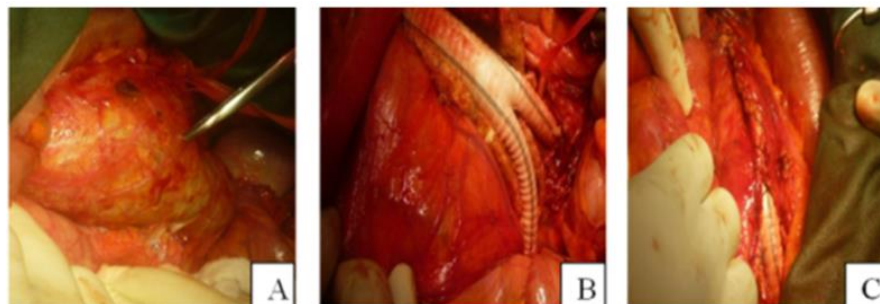


Figure 3. Intraoperative view of an aneurysm of the sub-renal abdominal aorta encompassing both primitive iliac arteries: (A) aneurysmal sac, (B) inverted “Y” vascular prosthesis in place, and (C) redraping of the aneurysmal sac on the prosthesis.

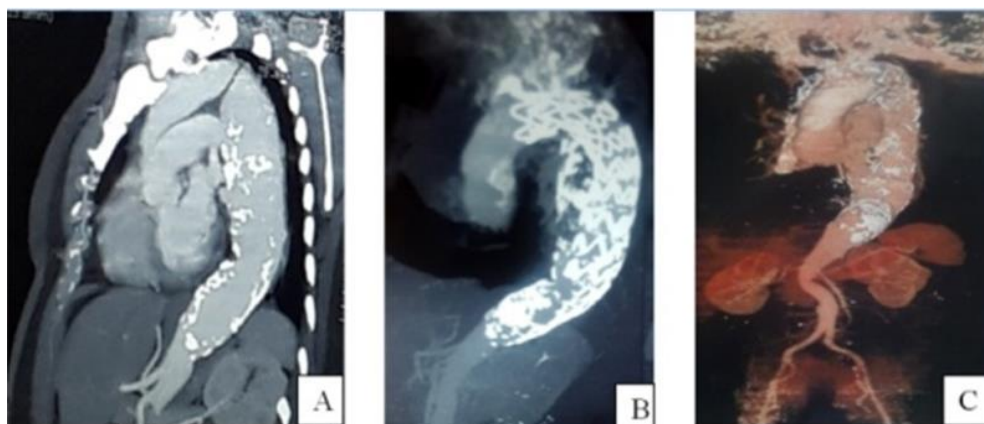


Figure 4. Angiotomodensitometric image of endovascular procedure of an aneurysm of the descending thoracic aorta: (A) aneurysm of the descending thoracic aorta, (B) endoprosthesis in place in the descending thoracic aorta, and (C) reconstruction of the descending thoracic aorta after the endovascular procedure.

the endovascular procedure for the 9 patients was 15 h (Range 8-21 h) and the average length of stay in hospital was 03 days and 12 h (Range 2-4 days).

The post-operative course of the 28 conventional surgical cases was as follows: three patients died in the immediate postoperative period (less than 24 h) in intensive care. A fourth patient died on the 23rd postoperative day due to complications of renal failure. One patient had a short-term complication; it was an abscess of the psoas muscle. This abscess was due to infection at the site of the retroperitoneal haematoma (caused by a ruptured aneurysm). This abscess had required a surgical revision that consisted in the evacuation of the pus and an abundant washing with isotonic saline mixed with povidone-iodine; this allowed the preservation of the aortic vascular prosthesis with a favourable evolution under antibiotic treatment. Post-operative evolution of the 9 cases of endovascular procedures was marked by an immediate and short-term favorable outcome in all patients. However, one patient

died at 15 months after the endovascular procedure due to a rupture of the thoracic aorta caused by an endoleak. The total number of deaths was 5 out of the 37 patients in our series.

DISCUSSION

In line with literature data (Fauvel et al., 2003; Handa et al., 2011; Guegang et al., 2014), aneurysms of aorta in our series are mostly located in the sub-renal abdominal aorta. According to the literature, the fusiform form is more frequent (Ponti et al., 2012; Paraskevas et al., 2009; Zarins et al., 2000); this is in line with our results. The rate of emergency intervention in our series was similar to the results of Côté et al. (2012), outside of any screening context.

Regarding the approach for conventional surgery on the abdominal aorta, vertical median laparotomy is more suitable for an aorto-iliac aneurysm; however, the

retroperitoneal approach is preferable for treating a juxtarenal aneurysm because it can be easily enlarged to control the suprarenal aorta in case of difficult anastomosis (Ricco and Sessa, 2010); we used suprarenal clamping in three patients in our series during retroperitoneal approaches. As the elective approach for ascending thoracic aortic aneurysms (Guegang et al., 2014; Ricco and Sessa, 2010), vertical median sternotomy was performed in all three patients with ascending thoracic aortic aneurysms.

Flattening-grafting or endovascular stent graft is the surgical procedures performed for abdominal aortic aneurysms (Beaujeu et al., 2011; Hannawa et al., 2009; Salomon Du Mont et al., 2015). Aneurysms of the descending thoracic aorta are preferentially treated by endovascular procedures. However, long before the acquisition of the hybrid room by the Abidjan Heart Institute, a case of ruptured aneurysm of the descending thoracic aorta has been treated with a rescue prosthetic graft flattening without success. The patient died within the first 24 h after surgery. Khan et al. (2009) recorded an average procedure time of 151 min for conventional surgery. Prinssen et al. (2004) reported 162.5 min, our series reported a mean time of 220 min. This long operating time was probably due to the complexity of the cases operated for a long time only by conventional surgery before the advent of endovascular procedures in our center. The operative mortality rate was 4.6% in the series of Prinssen et al. (2004) and 11.89% in the series of Menezes et al. (2016), the operative mortality in our series was 10.81% with an overall mortality of 13.51%. In the series of Schermerhorn et al. (2008), complications were dominated by myocardial infarction, pneumonia and acute renal failure. In our series, acute renal failure and retroperitoneal abscess were the major postoperative complications. In recent years, the benefit of endovascular procedures in the treatment of aneurysms located in the descending thoracic aorta has been demonstrated (Nienaber et al., 2009). However, while European markets are well supplied with stents (Lesquelen et al., 2009), this is not the case in sub-Saharan Africa in general and in Côte d'Ivoire in particular. Indeed, the unavailability of stents and their high cost remain limiting factors in the popularisation of endovascular procedures for the few cardiovascular surgery departments that have a hybrid room. However, the shortening of the average hospital stay in our series, which is in line with the literature (Khan et al., 2009; Menezes et al., 2016), and the low immediate postoperative morbidity of these endovascular procedures should encourage practitioners in sub-Saharan Africa to establish partnerships with the laboratories that produce these stents. Endoleak is the most common complication of the endovascular procedure. It leads to an enlargement of the aneurysm with a risk of rupture (Taieb et al., 2016). The case of death was due to aneurysmal rupture by endoleak. These endoleaks should be diagnosed and treated on time for the recommended

annual CT check-ups.

Conclusion

Aneurysms of aorta are uncommon in sub-Saharan Africa, but their prevalence is gradually increasing. Aneurysms are the most often found in the abdominal aorta under the kidneys. The curative treatment of aneurysms is bimodal, either by conventional surgery or by endovascular procedures. These two complementary methods have considerably improved the management of patients suffering from aneurysms of aorta in Côte d'Ivoire in recent years.

CONFLICT OF INTERESTS

The authors have no conflicts of interest to disclose.

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