Acta Scientific MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 10 Issue 1 January 2026

Case Study

Case Series of Abdominal Aortic Open Surgery in the Presence of Horseshoe Kidney

Milanko Maksic[1,2], Momir Bobar[2]*, Jelena Inđić Četić[2], Stefan Dučić[3,4] and Lazar B Davidovic[3,4]

[1]Faculty of Medicine, University of Banja Luka, Bosnia and Herzegovina

[2]Clinic for Vascular Surgery, Clinical Center of Republic of Srpska, Bosnia and Herzegovina

[3]Faculty of Medicine, University of Belgrade, Serbia

[4]Clinic for Vascular and Endovascular Surgery, University Clinical Center of Serbia, Serbia

***Corresponding Author:** Momir Bobar, Clinic for Vascular Surgery, Clinical Center of Republic of Srpska, Bosnia and Herzegovina.

DOI: 10.31080/ASMS.2026.10.2198

Received: December 01, 2025

Published: December 31, 2025

© All rights are reserved by **Momir Bobar., *et al.***

Abstract

The co-existence of abdominal aortic aneurysm (AAA) and horseshoe kidney (HK) is rare. However, horseshoe kidney limits access to the abdominal aorta during open surgery.

This is a retrospective single-center study which includes four patients with horseshoe kidney who underwent open surgery of the abdominal aorta in the Department of vascular surgery, Clinical Center of the Republic of Srpska between 2020 and 2025. Three patients had abdominal aortic aneurysm, while one had aortoiliac occlusive disease. According to Crawford classification, all patients had type II of horseshoe kidney vascularization (two normal and 1-3 anomalous renal arteries originating from infrarenal aorta or from iliac arteries).

In all cases midline laparotomy incision was used, while renal isthmus was preserved. In three cases that required aortic cross clamping above the anomalous renal arteries, renal protection was used. All significant anomalous renal arteries (diameter larger than 3mm) were preserved. There were no cases of renal failure and mortality during the first 30 postoperative days, as well as after the mean follow-up period of 30.75 months.

In majority of cases open surgery is the first choice for the treatment of abdominal aortic diseases in the presence of horseshoe kidney. It requires careful planning of operative strategy, including exact preoperative identification of HK vascularization and collecting systems anatomy. We recommend the midline laparotomy approach and preservation of the renal isthmus and all significant renal arteries. EVAR can be used selectively if patients with associated horseshoe kidney have suitable anatomy.

Keywords: Open Surgery; Horseshoe Kidney; Case Series; Midline Laparotomy

Abbreviations

AAA: Abdominal Aortic Aneurysm; HK: Horseshoe Kidney; OS: Open Surgery; EVAR: Endovascular aneurysm Repair; RAAA: Ruptured Abdominal Aortic Aneurysm; ACC: Aortic Cross Clamping; AII: Aortobiiliac Bypass; AFF: Aortobifemoral Bypass; IVC: Inferior Vena Cava; COPD: Chronic Obstructive Pulmonary Disease

Introduction

Horseshoe kidney (HK) is the most common congenital anomaly of the kidneys. According to some reports, it is occurring in 0.15-0.25% of all newborns [1,2]. The main characteristic of this anomaly is medial fusion of the two kidneys anteriorly or occasionally posteriorly to the abdominal aorta [1-3]. Usually the renal isthmus consists from simple fibrotic tissue or, less frequently, from highly vascularized renal parenchyma [2-6]. Mostly, each renal body has its own collecting system, with the ureter on the appropriate side [3,5]. 30% of patients with HK have two normal, while more than 60% have multiple renal arteries [7-10]. There are three classifications of HK vascularization. Eisendrath`s classification from 1925, which is the oldest, is based on number of renal arteries [2]. It includes five types of HK vascularization. Type I: There are two renal arteries, one for each side of the HK (20% of cases). Type II: There is one renal artery for each side of the HK and one aortic brunch to the renal isthmus (30% of cases). Type III: There are two arteries for each side of the HK and one artery for renal isthmus (15% of cases). Type IV: There are two arteries for each side of the HK with one or more arteries arising from iliac arteries, including the isthmus branch (15% of cases). Type V: There are multiple renal arteries originating from the aorta, mesenteric and iliac arteries (20% of cases) [2]. Papin's classification from 1928 is also based on the number of renal arteries. Papin I, which is presented in 20% of cases, includes HK with two normal renal arteries. Papin II of HK, which includes 3-5 renal arteries, is presented in 66% of cases, while Papin III, with more than 5 renal arteries, is presented in 14% of patients with HK [11]. Crawford's classification, based on the origin of renal arteries, is the most popular one for vascular surgeons. According to this classification, there are three types of HK vascularization. Crawford type I includes HK with two renal arteries that have normal origin. Patients with Crawford type II of HK vascularization have two normal and 1-3 anomalous renal arteries originating from infrarenal aorta or from iliac arteries. Finally, in Crawford III of HK all renal arteries have an anomalous origin [5,6]. Patients with HK are usually asymptomatic without disorder of renal function [6]. The co-existence of abdominal aortic aneurysm (AAA) and HK is rare, occurring only in 0.12-0.2% of patients requiring aneurysm repair [8,13-15]. However, the occurrence of HK limits access to the distal abdominal aorta during open surgery [5-10,12,14-16]. The aim of this study includes a presentation of four cases in which patients with HK underwent open surgical repair of abdominal aorta and an assessment of optimal management of abdominal aortic disease in the presence of this congenital renal anomaly.

Case Series

This paper includes a retrospective case series of four patients who underwent open surgery (OS) of abdominal aorta with the presence of HK in the Department of vascular surgery, Clinical Center of the Republic of Srpska from 2020 to 2025, as well as an evaluation of the treatment options for these patients. The study was performed in accordance with the ethical standards of the responsible with the Helsinki Declaration of 1964 and its later amendments. Informed consent was obtained from all patients included in the study.

Result

In the period between 2020 and 2025 overall, four patients were diagnosed with primary abdominal aortic disease and associated HK in the Department of vascular surgery, Clinical Center of the Republi**c** of Srpska. All our patients were male with the average age of 67 years (range, 62-73). Three of our patients had asymptomatic AAA with diameter of 62, 59 and 65 millimeters. One patient had aortoiliac occlusive disease manifested with disabling claudication discomforts. Associated comorbidities has included arterial hypertension- three cases (75%); Diabetes Mellitus-one case (25%); chronic obstructive pulmonary disease (COPD)-one case (25%); aortic valve stenosis-one case (25%) and dyslipidemia-three cases (75%). Three (75%) of our patients were smokers. Table 1 presents preoperative baseline characteristics of our patients.

All patients underwent MDCT angiography. In three cases the examination revealed infrarenal AAA, while in one case

No	Demography		Comorbidity and Risk Factors					
	Sex	Age (y)	Arterial Hypertension	Diabetes Mellitus	Dyslipidemia	Cigarette Smoking	Cardiac Diseases	COPD
1.	M	71	Yes	No	Yes	Yes	No	Yes
2.	M	73	Yes	No	Yes	No	No	No
3.	M	62	Yes	No	Yes	Yes	No	No
4.	M	62	No	Yes	No	Yes	Aortic Valve Stenosis	No

Table 1: Preoperative baseline characteristics.

Legend: No- patient number; y- year; COPD- chronic obstructive pulmonary disease.

aortoiliac occlusive disease. In all patients HK was also found. The renal isthmus in all cases consisted from highly vascularized renal parenchyma. All of our patients had multiple renal arteries. According to Crawford classification, all of them had type II of HK vascularization (two normal and 1-3 anomalous renal arteries originating from infrarenal aorta or from iliac arteries) [5,6]. In all patients renal bodies had their own collecting system, with the ureter on the appropriate side. The patient number 1**,** besides two normal**,** had one an**o**malous isthmic artery which originated from the aneurysm neck. The patient number 2. had two normal and two anomalous renal arteries. One of them, with diameter smaller than 3 mm, originated from the aneurysm sac, while another originated from the right iliac artery (Figure 1A). The patient number 3, besides two normal, had two anomalous renal arteries. One of these anomalous renal arteries originated from the aneurysm neck, while the other from the left common iliac artery. Finaly the patient number 4. had two normal and two anomalous renal arteries. The first of them originated from infarenal aorta, while the other one from an iliac artery. HK vascularization is presented in the table 2.

All four patients underwent OS of abdominal aorta under general anesthesia. Midline laparotomy incision was used as surgical approach in all four cases. A proximal bleeding control was performed by using infrarenal aortic cross-clamping (ACC) in all cases. Patients with AAA had replacement with bifurcated prosthetic Dacron graft. In two cases, both distal anastomoses were performed on the iliac arteries, while in the third case, on common femoral arteries. Patient number 4, with aortoiliac occlusive disease**,** underwent standard aortobifemoral reconstruction using

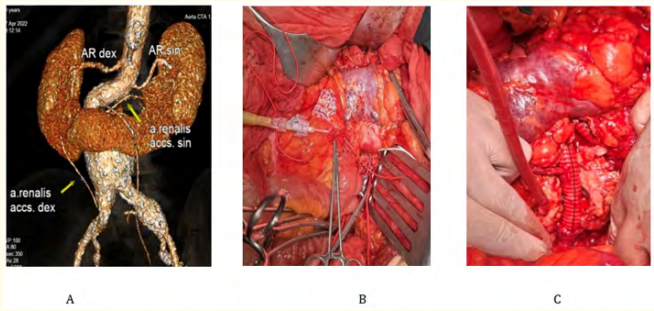

Figure 1: Patient number 2: AAA with 2 normal renal arteries and with 2 anomalous renal arteries. One of them originated from the aneurysm sac while the other from the common iliac artery. A) MDCT angiography. B) Intraoperative picture presents renal protection after selective canulation of the anomalous renal artery originating from the right common iliac aneurysm. C) Intraoperative picture presents right anomalous renal artery after its reattachment into right limb of the bifurcated graft which is positioned under the renal isthmus.

No	Abdominal Aortic Disease	Number of renal arteries	Crawford Classification [5]
1.	AAA	2 normal arteries 1 anomalous artery from the aneurysm neck	Type II
2.	AAA	2 normal renal arteries 1 anomalous artery from the aneurysm sac 1 anomalous artery from the right iliac artery	Type II
3.	AAA and iliac occlusion	2 normal arteries 2 anomalous arteries from the aneurysm neck 1 anomalous artery from the left iliac artery	Type II
4	Aorto-iliac occlusive disease	-2 normal arteries -1 anomalous from the infarenal aorta -1 anomalous from the iliac artery	Type II

Table 2: Vascularization of the horseshoe kidney.

Legend: No- patient number.

also bifurcated Dacron graft (Figure 2B). The proximal anastomosis had side-to-end shape (Figure 2A). In all four cases renal isthmus transection was avoided. Instead of that**,** renal isthmus was mobilized from the anterior aneurysm/aortic wall and after that vascular graft was passed out under it.

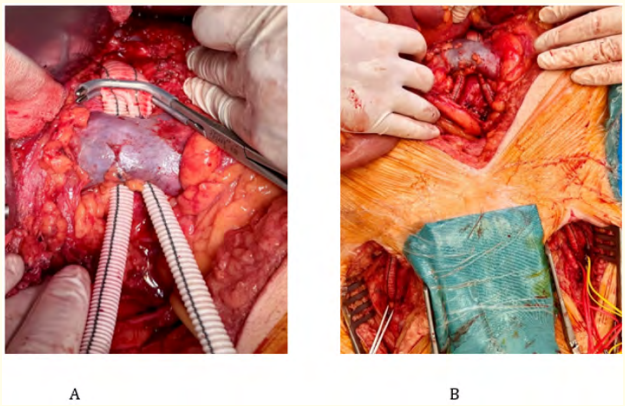

Figure 2: An intraoperative picture of patient number 4 with two normal and two anomalous renal arteries. The first of them originated from infarenal aorta while another from iliac artery. All two anomalous renal arteries were preserved thanks to side-to-side proximal aortic anastomosis. A) The placement of bifurcated graft under the renal isthmus after finishing of side-to-side proximal aortic anastomosis. B) The finishing of both distal anastomoses.

In three cases ACC was performed above the origin of anomalous renal arteries. In each we used renal protection. It included kidneys perfusion after selective catheterization of anomalous renal arteries with cold (+4°C) solution which consisted of 125 mg Methylprednisolone, 12.5 g/L 20% Mannitol and 5000 IU of heparin added to 500 ml of cooled saline (Figure 1B). We preserved all the significant renal arteries with diameter higher than 3 mm. In patient number 1. anomalous renal artery was preserved thanks to its location above the proximal aortic anastomosis. In patient number 2**,** the anomalous renal artery originated from the aneurysmal sac was ligated (diameter less than 3 mm), while the other one was reattached into the right limb of the vascular graft (Figure 1C). In patient number 3, two anomalous renal arteries were preserved thanks to their location above the proximal anastomosis, while one was reattached into the left limb of vascular graft. In patient number 4, all anomalous renal arteries were preserved thanks to side-to-end shape of proximal aortic anastomosis (Figure 2A). The data about perioperative procedures are presented in table 3.

There were no cases of mortality and renal failure during the first 30 postoperative days. After the mean follow-up period of

No	Aortic Repair	Procedure with Isthmus	Procedure with Anomalous Renal Arteries
1.	AII Bypass	Preserved	Preserved above the proximal anastomosis
2.	AII Bypass	Preserved	One (<3 mm) was ligated. One was reattached into the right limb of vascular graft.
3.	AFF Bypass	Preserved	Two were preserved above the proximal anastomosis. One was reattached into the left limb of vascular graft.
4.	AFF Bypass	Preserved	Preserved thanks to side-to-end proximal aortic anastomosis.

Table 3: Perioperative procedures.

Legend: No- patient number; AII- aortobiiliac bypass; AFF- aortobifemoral bypass.

30.75 months (6-60) there were also no cases of renal failure and mortality. Table 4 presents early and long-term results.

No	30-Day-Outcomes		Follow Up (months)	Long-term Results	
	Renal Failure	Survival		Renal Function	Survival
1.	No	Yes	60	Normal	Yes
2.	No	Yes	31	Normal	Yes
3.	No	Yes	26	Normal	Yes
4.	No	Yes	6	Normal	Yes

Table 4: Early and long-term outcomes.

Discussion

The first successful repair of an AAA in the presence of a HK was described by Phelan and co in 1957 [17]. Three studies with a larger number of such cases emerged afterwards [7,9,18]. The first of them was single center study with 8 cases [18]. A review from 1975 has included the total number of 34 cases [7], while review from 1993 has included the total number of 19 cases [9]. During the past twenty years three articles have also been published by authors from the Clinic for Vascular and Endovascular Surgery of the University Clinical Center of Serbia. The first study from 2004 included 12 cases of open repair (OR) of abdominal aorta in the presence of HK [12]. The second study from 2011 has included 25 new cases of AAA open repair and associated HK [6]. Finaly, the last study from 2018 was described six patients with OR of ruptured AAA (RAAA) in the presence of HK [19].

The main technical consideration during elective OR of abdominal aortic disease in patients with associeted HK, includes the choice of surgical approach, as well as the procedure with renal isthmus and with anomalous renal arteries. Midline laparotomy and left retroperitoneal approaches are available for OS of abdominal aortic pathology in patients with associated HK. Both have their own advantages and disadvantages. The main technical advantages of midline laparotomy include the ability for the treatment of associated iliac and femoral artery pathology (especially on the right side), as well as clearly identification of HK vascularization and collecting system anatomy [6,8,19-23]. At the same time**,** midline laparotomy is more comfortable for anesthesiologists during urgent OR of RAAA with associated HK, especially if patients are hemodynamically unstable, or even if they require reanimation [10]. Majority of authors recommend midline laparotomy during OR of RAAA in the presence of HK [8,21-48]. However, if midline laparotomy is used, the isthmus of HK makes more difficult or even disables surgical approach to abdominal aorta, especially during AAA OR. A preservation of the isthmus and reattachment of anomalous renal arteries are much easier using

left retroperitoneal approach [10]. Namely, if the renal isthmus consists of renal parenchyma, its transection and division increase the risks of urinary fistula, urinary leakage, sepsis, or hemorrhage. This risk is especially high if the isthmus contains elements of the collecting system [6,9,13]. In a meta-analysis of 176 patients with HK and AAA, division of the renal isthmus was associated with increased postoperative renal insufficiency as well. According to the review of the literature**,** the midline laparotomy required transection and division of the renal isthmus in 34% of cases during AAA OR [13,21]. In most cases the renal isthmus was left intact**,** while the graft was simply tunneled under it [6,11,13,19,21]. Due to this, some authors recommend the mobilization of the isthmus from the aneurismal wall [22,24,25,27,31,32,36,40,44]. We preserved renal isthmus in all of our cases. The vascular graft can also be placed through the aneurysmal sac after opening its anterior wall after aortic cross clamping [6,12,10]. Majority of authors recommend the division (transection) of the renal isthmus during emergency repair of RAAA with associated HK [8,21,23-25,27-30,33-35,37-39,43,44]. The next challenge during OR of the abdominal aorta in association with HK includes procedures with anomalous renal arteries. The most recently published guidelines recommend preservation of all accessory and anomalous renal arteries larger than 4mm in diameter or those that supply more than 30% of kidney.

A preservation of anomalous renal arteries during OR of abdominal aorta includes their reattachment into vascular graft and bypass from the aortic graft to them [6,12,19]. According to review of the literature from 2018, in 26.82% cases anomalous renal arteries have been ligated, while in 19.51% preserved using different reconstructive procedures [19]. Ligature of significant renal arteries increased risk of postoperative renal failure, especially in patients with preexisted problems with renal function. We preserved all significant anomalous renal arteries. In our case 1 two normal and one anomalous renal artery were positioned above the proximal aortic anastomosis. In case 4 all anomalous renal arteries were preserved thanks to end-to-side shape of proximal anastomosis. In cases 2 and 3 we performed reattachment of accessory renal arteries using Carrel patch. Only in patient number 2 the anomalous renal artery originated from the aneurysmal sac was ligated (diameter less than 3 mm). It was no consequences on postoperative renal function. Procedures with renal arteries can cause renal ischemia, especially if the number of anomalous renal arteries is large. In such cases, renal protection is recommended. We performed it by kidneys perfusion after selective catheterization of anomalous renal arteries with cold (+4°C) solution, which consisted of 125 mg Methylprednisolone, 12.5 g/L 20% Mannitol and 5000 IU of heparin added into 500 ml of cooled saline. According to the same reports, the use of Custodiol provides improved perioperative renal function compared with other solutions. The first successful repair of RAAA in the presence of HK was described by Manick in 1964 [22]. Besides already described problems, the repair of RAAA in patients with associated HK has one problem more. That is a bleeding control. Authors with significant experience in the OR of RAAA suggest routine supraceliac ACC for proximal bleeding control [19]. Namely, in the presence of retroperitoneal hematoma**,** caused by RAAA**,** standard infrarenal ACC increases risk of iatrogenic injuries of surrounding structures**,** including abdominal aorta, inferior vena cava (IVC), duodenum, and HK. On the contrary, supraceliac ACC enables us to prevent those iatrogenic injuries. An experienced vascular surgeon usually needs less than 10 minutes from the initiation of laparotomy to supraceliac ACC**,** which is a fast, efficient and safe proximal bleeding control [19]. At the same time**,** the distal bleeding control can be performed by the placement of ballon occlusive catheters into both iliac arteries after the opening of the aneurysm sac. This maneuver simplifies the procedure and prevents iatrogenic injuries to the iliac veins and ureters in the presence of retroperitoneal hematoma [19].

EVAR improved significantly treatment of AAA. However, could the same be said for patients who have AAA associated with HK? If the EVAR is chosen, surgical approach and renal isthmus should not be considered during the treatment of AAA with associated HK. From the first such procedure in 1997 till 2018, 26 EVARs in patients with HK were reported [48]. On the other hand, the main disadvantage includes problems with anomalous renal arteries. EVAR mostly requires their covering to achieve an adequate proximal landing zone. It is always followed by partial renal infarction and the same stage of renal failure, which is not recommended in patients with preexisted renal failure. The new advanced option could be the usage of customized fenestrated stent graft, which enables a preservation of all significant accessory renal arteries with no change in renal function.

Conclusion

In majority of cases, open surgery is the first choice for the treatment of abdominal aortic diseases in the presence of HK. It requires an exact preoperative identification of HK vascularization and collecting systems anatomy and careful planning of operative strategy. We recommend the midline laparotomy approach. A preservation of the renal isthmus consisting of renal parenchyma and reattachment of all significant renal arteries should be conventional standard in contemporary practice during OS of abdominal aorta. EVAR can be used selectively if patients with associated HK have suitable anatomy.

Bibliography

1. Bertin FI., *et al*. "Dissection aigue de l'a0rte sous renale et rein en fer a cheval. A propos d'un cas et revue de la literature". *Chir (Paris)* 129.6-7 (1992): 330-334.
2. Eisendrath DN., *et al*. "Horseshoe kidney". *Annals of Surgery* 82.5 (1925): 735-764.
3. Artioukh DY., *et al*. "Problems of Abdominal Aortic Aneurysm Associated with Horseshoe Kidney". *European Journal of Vascular and Endovascular Surgery* 14.1 (1997): 75-78.
4. Gutierrez R. "The clinical management of horseshoe kidney". *American Journal of Surgery* 14 (1931): 657-61.
5. Crawford ES., *et al*. "The impact of renal fusion and ectopia on aortic surgery". *Journal of Vascular Surgery* 8.4 (1988): 375-383.
6. Davidović L., *et al*. "Repair of abdominal aortic aneurysm in the presence of the horse shoe kidney". *Internal Angiology* 30.6 (2011): 534-540.
7. Bietz DS and Merendino KA. "Abdominal aneurysm and horseshoe kidney: a review". *Annals of Surgery* 181.3 (1975): 333-341.
8. Sidell PM., *et al*. "Horseshoe kidney associated with surgery of abdominal aorta". *Mayo Clinic Proceedings* 54.2 (1979): 97-103.
9. O'Hara PJ., *et al*. "Surgical management of aortic aneurysm and coexistent horseshoe kidney: Review of a 31-year experience". *Journal of Vascular Surgery* 17.5 (1993): 940-947.
10. Shortell CK., *et al*. "Operative management of coexistent aortic disease and horseshoe kidney". *Annals of Vascular Surgery* 9.1 (1995): 123-128.
11. Papin E. "Chirurgie du Rein". Anomalies du Rein. Paris, G. Dion (1928): 205-220.
12. Davidović L., *et al*. "Abdominal Aortic Surgery and Horseshoe Kidney". *Annals of Vascular Surgery* 18.6 (2004): 725-758.
13. De Vigilio C., *et al*. "Renal artery anomalies in patients with horseshoes of ectopic kidneys: the challenge of aortic reconstruction". *Cardiovascular Surgery* 3.4 (1995): 413-420.
14. Faggioli GL., *et al*. "Renal anomalies in aortic surgery: contemporary results". *Surgery*133.6 (2003): 641-646.
15. Bergan JJ and Yao JST. "Modern management of abdominal aortic aneurysm". *Surgical Clinics of North America* 54.1 (1974): 175-193.
16. Starr DS., *et al*. "Resection of abdominal aortic aneurysm in the presence of horseshoe kidney". *Surgery* 89.3 (1981): 587-589.
17. Phelan JT., *et al*. "Abdominal aortic aneurysm associated with a horseshoe kidney: report of case". *Mayo Clinic Proceedings* 32.4 (1957): 77-81.
18. Scott R., *et al*. "Surgical correction of abdominal aortic disease in 8 patients with horseshoe kidney". *Journal of Urology* 102.1 (1969): 21-26.
19. Davidovic L., *et al*. "Open repair of ruptured abdominal aortic aneurysms with associated horseshoe kidney". *Internal Angiology* 37.6 (2018): 471-478.
20. Bietz DS and Merendino KA. "Abdominal aneurysm and horseshoe kidney: A review". *Annals of Surgery* 181.3 (1975): 333-341.
21. Connelly TL., *et al*. "Abdominal aortic surgery and horseshoe kidney: report of six cases and a review". *Archives of Surgery* 115.12 (1980): 1459-1463.
22. Mannick JA., *et al*. "Ruptured aneurysm of the abdominal aorta; a reappraisal". *The New England Journal of Medicine* 271 (1964): 915-920.
23. Sigler L and Geary JE. "Abdominal aortic aneurysm and unexpected horseshoe kidney". *Journal of Cardiovascular Surgery* 10.4 (1969): 320-323.

24. Cayten CG., *et al*. "Ruptured abdominal aortic aneurysms in the presence of horseshoe kidneys". *Surgery Gynecology and Obstetrics* 135.6 (1972): 945-949.

25. Vereecken L., *et al*. "A case of ruptured aortic aneurysm associated with horseshoe kidney". *Acta Chirurgica Belgica* 72.1 (1973): 46-49.

26. Barrie WW., *et al*. "Abdominal aortic surgery and horseshoe kidney". *Journal of the Royal College of Surgeons of Edinburgh* 20.2 (1975): 124-127.

27. Van Gelderen PW., *et al*. "Ruptured aneurysm of the abdominal aorta in the presence of a horseshoe kidney". *Archives of Chirurgia and Nefrologia* 27.4 (1975): 271-276.

28. Bugge-Asperheim B., *et al*. "Horseshoe kidney and ruptured abdominal aortic aneurysm". *Scandinavian Journal of Urology and Nephrology* 11.1 (1977): 89-92.

29. Landes RG., *et al*. "Abdominal aortic aneurysm with rupture into inferior vena cava associated with horseshoe kidney". *Annals of Surgery* 187.3 (1978): 329-331.

30. Schwilden ED., *et al*. "Ruptured Aortic aneurysm and horseshoe kidney-case report and collective review". *Langenbeck Arch Chir* 346.2 (1978): 135-148.

31. Mcloughlin MG., *et al*. "Cake kidney with abdominal aneurysm". *Canadian Journal of Surgery* 21.4 (1978): 367.

32. Zisis EG., *et al*. "Abdominal aortic aneurysm associated with horseshoe kidney. A case report". *Vascular Surgery* 12 (1978): 198-203.

33. Donati A., *et al*. "Abdominal aortic aneurysm and horseshoe kidney". *Journal of Cardiovascular Surgery* 21.5 (1980): 632-636.

34. Poulias GE., *et al*. "Successful resection of ruptured abdominal aortic aneurysm into the inferior vena cava, in the presence of a horseshoe kidney. Case report and review of literature". *Journal of Cardiovascular Surgery* 23.5 (1982): 415-421.

35. Gillet M., *et al*. "Abdominal aortic aneurysm ruptured into the inferior vena cava, and horseshoe kidney". *Chirurgie* 108.10 (1982): 811-815.

36. Dutoit DF., *et al*. "Ruptured abdominal aortic aneurysm and horseshoe kidney. A case report". *South African Journal of Surgery* 64.19 (1983): 750-751.

37. Gutowicz MA and Smullens SN. "Ruptured abdominal aortic aneurysm with horseshoe kidney". *Journal of Vascular Surgery* 1.5 (1984): 689-691.

38. Hardin CA. "Abdominal aortic surgery and horseshoe kidney". *Kans Medicine* 87.10 (1986): 274-275.

39. Pender DJ. "Ruptured abdominal aortic aneurysm with horseshoe kidney". *British Journal of Hospital Medicine* 35.6 (1986): 414-415.

40. Costantino MJ and Montgomery TA. "Horseshoe kidney associated with aortic aneurysm". *Journal of the Medical Association of Georgia* 75.4 (1986): 212-214.

41. Proud G. "Ruptured abdominal aortic aneurysm with horseshoe kidney". *British Journal of Hospital Medicine* 36.5 (1986): 386.

42. Moer A and Solheim K. "Horseshoe kidney and abdominal aortic aneurysm". *Tidsskr Nor Laegeforen* 107.6 (1987): 540-541.

43. Svensson LG., *et al*. "Successful management of ruptured septic aortic aneurysm and horseshoe kidney with multiple renal arteries. A case report". *South African Journal of Surgery* 25.4 (1987): 161-163.

44. Tapper SS., *et al*. "Ruptured abdominal aortic aneurysm and horseshoe kidney". *South Medical Journal* 83.2 (1990): 224-226.

45. Yaman M., *et al*. "Two patients with horseshoe kidney and ruptured abdominal aortic aneurysm". *Canadian Journal of Surgery* 34.3 (1991): 238-241.

46. Bertin F., *et al*. "Acute dissection of the infrarenal aorta and horseshoe kidney. A propos of a case and review of the literature". *Journal De Chirurgie (Paris*) 129.6-7 (1992): 330-334.

47. Giorgetti PL., *et al*. "The rupture of an abdominal aortic aneurysm in a patient with a fused horseshoe kidney. A clinical case report". *Minerva Chir* 47.1-2 (1992): 59-63.

48. Teijink JA., *et al*. "Ruptured AAA in a patient with a horseshoe kidney: emergent treatment using the talent acute endovascular aneurysm repair kit". *Journal of Endovascular Therapy* 10.2 (2003): 240-243.