RENAL ARTERY THROMBOSIS SECONDARY TO BLUNT ABDOMINAL TRAUMA: RARE CASE SERIES

[1]Ahmad Nurfakhri Syarief, [2]Fikri Rizaldi.

[1] Department of Urology, Faculty of Medicine/Universitas Airlangga, Soetomo General Hospital, Surabaya.
[2] Department of Urology, Faculty of Medicine/Universitas Airlangga, Universitas Airlangga Teaching Hospital, Surabaya.

ABSTRACT

Objective: *This study aims to report the possibility of non-operative management (NOM) as a Renal artery thrombosis (RAT) treatment.* ***Case(s) Presentation:*** *In this series, we reported 3 cases of unilateral RAT secondary to blunt abdominal trauma treated with NOM, where patient had complete bed rest, close observation, laboratory tests, and serial imaging. During a first-month follow-up, hypertension, renal abscess, persistent flank pain, or impairment of renal function were not found in the patients. However, after a one-year follow-up, an atrophic kidney appeared due to RAT in one of our cases.* ***Discussion:*** *RAT secondary to blunt abdominal trauma is rare. However, the management of RAT is still controversial. Renal preservation with NOM possesses reasonable success because the risk of complication does not exceed that of revascularization, and is currently considered.* ***Conclusion:*** *NOM is considered a treatment option in the cases of unilateral RAT with good contralateral renal function. This treatment provides a minimal number of complications.*

Keywords: *Renal artery thrombosis, non-operative management.*

ABSTRAK

Tujuan: *Tujuan dari penelitian ini adalah untuk melaporkan non-operative management (NOM) atau penatalaksanaan non-operatif sebagai tatalaksana yang mungkin pada Renal artery thrombosis (RAT) atau trombosis arteri ginjal.* ***Presentasi kasus:*** *Dalam serial kasus ini, kami melaporkan 3 kasus RAT unilateral sekunder akibat trauma tumpul abdomen yang ditatalaksana dengan NOM, di mana pasien harus istirahat total, observasi ketat, dan melalui tes laboratorium, dan pencitraan radilogi serial. Selama follow-up bulan pertama, hipertensi, abses ginjal, nyeri pinggang yang persisten, atau gangguan fungsi ginjal tidak didapatkan pada pasien. Namun setelah satu tahun follow-up, terdapat kejadian atrofi ginjal dalam salah satu kasus RAT kami.* ***Diskusi:*** *Trombosis arteri ginjal (RAT) yang diakibatkan karena trauma tumpul abdomen jarang terjadi. Namun, tatalaksana RAT masih kontroversial. Preservasi ginjal dengan manajemen non-operatif (NOM) memiliki keberhasilan yang baik karena risiko komplikasi tidak melebihi risiko revaskularisasi, dan saat ini mulai dipertimbangkan.* ***Simpulan:*** *NOM dianggap sebagai pilihan pengobatan dalam kasus RAT unilateral dengan fungsi ginjal kontralateral yang masih baik. Komplikasi yang terjadi dalam perawatan ini sangatlah minimal.*

Kata kunci: *Trombosis arteri ginjal, penatalaksanaan non-operatif.*

Correspondence: Fikri Rizaldi; c/o: Department of Urology, Faculty of Medicine/Universitas Airlangga, Universitas Airlangga Teaching Hospital. Jl. Dharmahusada Permai, Surabaya, East Java 60115, Indonesia. Email: fikririz@gmail.com. Phone: +62315916290.

INTRODUCTION

The kidney is a genitourinary organ that is most vulnerable to trauma. Renal trauma occurs in approximately 3% of all trauma patients and 8-10% of patients with abdominal trauma. Motor vehicle accidents (MVA), falls, and sports are the most common causes of blunt kidney trauma.[1-2] Most renal trauma does not require further intervention due to its mild morbidity. However, it can be life-threatening in some cases. The most common classification of kidney trauma is the American Association for the Surgery of Trauma (AAST) classification. This scoring system can describe anatomical damage and the severity of kidney trauma.[3]

Renal artery thrombosis (RAT) is a significantly rare complication and accounts for less than 1% of renal trauma cases. Management of RAT was considered controversial. Conventionally, nephrectomy is the treatment of choice for these cases. Nowadays, the management of RAT has

changed towards preserving the kidney through observation and conservative therapy, and if possible, including an immediate surgical revascularization procedure.[4-5] Non-operative management (NOM) in RAT cases is considered the safest and the most appropriate treatment in most patients due to the lower rate of abscess formation and long-term complications, like renovascular hypertension, compared to immediate revascularization.[6]

Due to its rarity and recent evolution in RAT management, this case series was created to report several cases of blunt trauma RAT in the emergency department treated with NOM. Minimal complications and the success rates formed with NOM on RAT cases in this case series are fascinating to observe.

CASE(S) PRESENTATION

A 24-year-old male patient was referred to the emergency department with chief complaint of shortness of breath after falling from height. The patient also suffered from upper right abdominal pain that radiated to his right back. Physical examination revealed decreased breath sounds on the right lung with a stable hemodynamic. A water seal drainage was immediately inserted due to a right pneumothorax on his chest X-ray.

The laboratory examination revealed leukocytosis, increased transaminase enzymes, decreased renal function, and microhematuria. Focused Assessment Sonography in Trauma (FAST) examination showed the presence of free fluid in four regions; Morrison pouch, splenorenal, paracolic, and perivesical region.

Abdominal Computerized tomography (CT) Scan with contrast couldn't be done due to the decreased renal function. Thus, the abdominal ultrasound was performed and revealed a heterogeneous parenchymal echo intensity on the liver with a decreased vascularity on the right kidney with irregular edges (Fig. 1).

This patient then underwent NOM with total bed rest and strict observation. There was a decrease in hematocrit, an increase in transaminase enzyme, and persistent impairment of renal function during the hospital stay. Therefore, a digestive surgeon was involved and performed an exploratory laparotomy surgery due to a suspicion of ongoing intra-abdominal bleeding. A grade III liver rupture with active bleeding and no hematoma in zone II and III were found during the surgery.

The anemic condition was resolved after surgery, followed by normal transaminase enzymes and renal function. So, abdominal CT scan with contrast was performed and revealed right renal infarct with a 1.7 cm long right renal artery discontinuity from abdominal aorta without contrast extravasation (Fig. 2). Based on the clinical condition and radiological examination, NOM remains the treatment of choice for his urological problem.

The patient had no more complaints at one-month postoperative follow-up. At a one-year follow-up, still no hypertension, flank pain, or hematuria was found on the patient. His renal function was also within normal limits. A Computerized tomography-intravenous urography (CT-IVU) examination was then performed and revealed a single left kidney (Fig. 3). The patient is then planned for yearly follow-up.

A 41-year-old male patient was brought to the emergency department with chief complaint of pain in the left upper chest and abdomen that radiates to the left back after getting into MVA. Physical examination revealed stable hemodynamics and tenderness on his left chest. A chest X-ray revealed

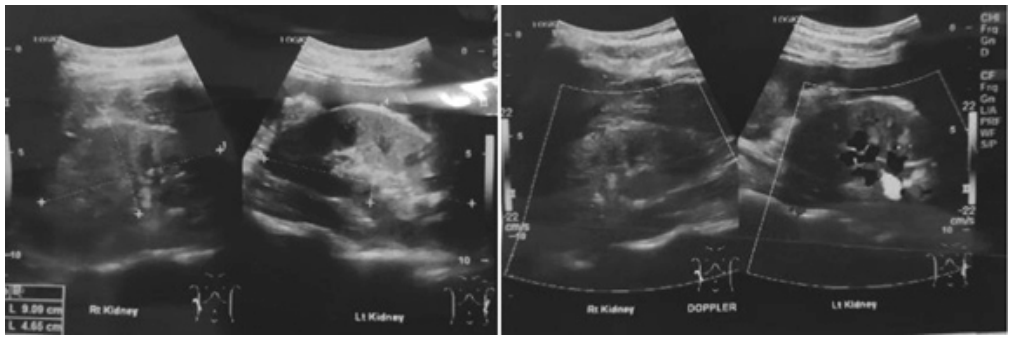

Figure 1. The abdominal US revealed a heterogeneous parenchymal echo intensity on the liver and a decreased vascularity on the right kidney.

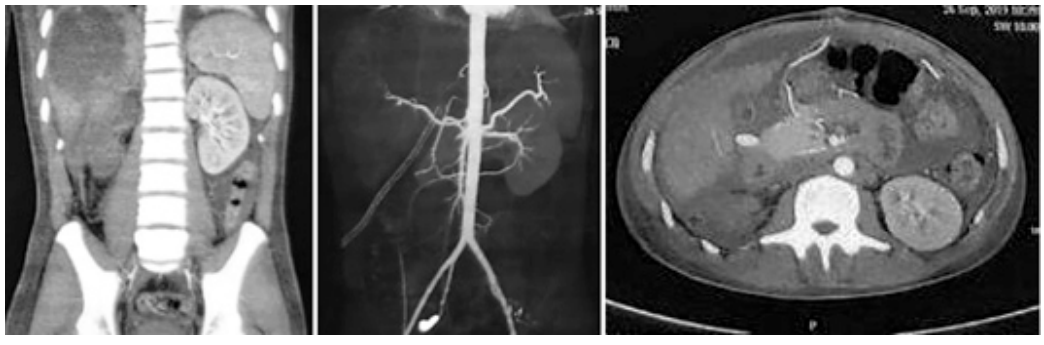

Figure 2. Abdominal CT scan with contrast showed right renal infarct with a 1.7 cm long right renal artery discontinuity from the abdominal aorta.

pulmonary contusion with 2-6 left posterior rib fractures.

The laboratory examination showed anemia without signs of active bleeding, leukocytosis, a slight decrease in renal function, and microhematuria. Free fluid was found in the morrison pouch, splenorenal, and perivesical region during FAST examination.

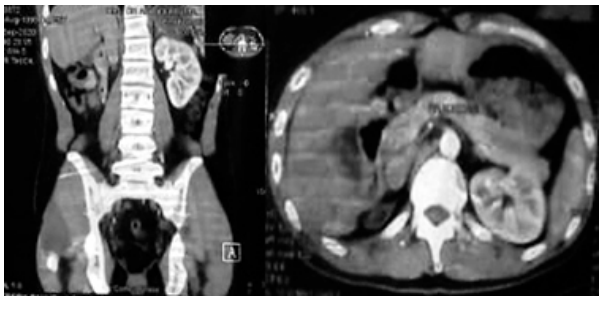

Figure 3. CT-IVU revealed single kidney S after a one-year follow-up from the right RAT.

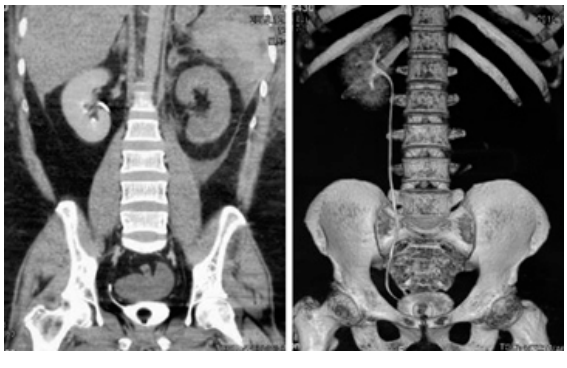

Figure 4. Abdominal CT scan showed no contrast fills or filtering out from the left kidneys accompanied by grade III spleen lacerations and hematomas.

An abdominal CT scan with contrast was performed and revealed grade III spleen lacerations accompanied by left renal artery discontinuity along +/- 1.6 cm from the abdominal aorta without vascularization to the left kidneys (Fig. 4). Angiography was also planned and showed total occlusion in the left renal artery with collateral vascularization in the upper renal capsule of the left kidney (Fig. 5).

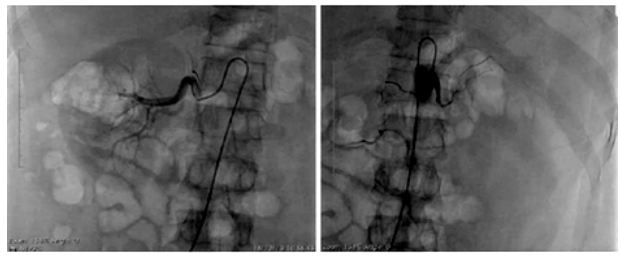

Figure 5. Angiography showed total occlusion in the left renal artery with collateral vascularization in the upper renal capsule of the left kidney.

Conservative therapy was planned based on his examination, followed by observation of vital signs, signs of peritonitis, and serial laboratory evaluation of blood and urine sediment. However, the patient complained of worsening pain and decreased breath sounds in the left chest. A left pneumothorax was found on the chest X-ray, and a chest tube was placed.

His vital signs were stable during his hospital stay, and there were no complaints after all after 11th days of treatment. At one month of post-traumatic follow-up, his blood pressure and renal function were also within normal limits. The patient was planned for annual check-up but lost to follow-up due to the Coronavirus Disease 2019 (COVID-19) pandemic.

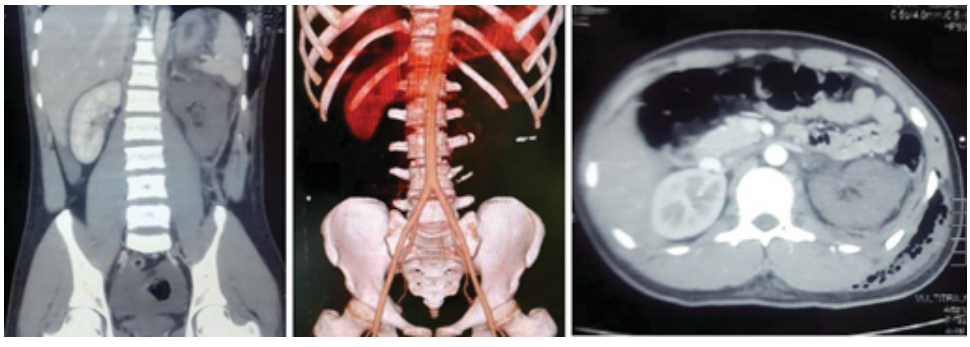

Figure. 6. Abdominal CT scan with contrast showed no vascularization to the left kidney accompanied by spleen laceration with intraparenchymal hematoma.

A 17-year-old male patient with chief complaint of shortness of breath was referred to the emergency department after getting into MVA. He came with a needle thoracotomy on his left chest due to pneumothorax and a sixth rib fracture on his X-ray. Thus, the water seal drainage was immediately placed. Physical examination revealed stable hemodynamics with an open wound on the left flank without any signs of active bleeding.

Laboratory examination revealed anemia with increased transaminase enzymes, and a slight increase in serum creatinine, while urinalysis showed microhematuria. The FAST examination revealed the presence of free fluid in the splenorenal and perivesical regions. Abdominal CT scan with contrast showed left renal artery discontinuity along +/- 1.2 cm from the abdominal aorta without any lacerations or vascularization to the left kidney accompanied by +/- 5.5 cm laceration of the spleen with posteromedial intraparenchymal hematoma (Fig. 6).

Based on his clinical and radiological examination, NOM was still the treatment of choice. Debridement and primary suture were done to treat the wound on his left flank region. Due to improvement of shortness of breath, stable vital signs, no fever or severe flank pain, the patient was then discharged after 14 days of treatment.

The patient had no complaint in a one-month follow-up. No hypertension found and his renal function was within the normal limit. However, this patient was also loss to follow-up due to the ongoing COVID-19 pandemic.

DISCUSSION

Kidney injury accounts for up to ten percent of all intra-abdominal trauma, more commonly in young men, with an incidence of 4.9 per 100.000 population.[3,7] The kidney remains at risk for injury involving penetrating objects, rapid deceleration, and high force energy. Deceleration force can particularly cause kidney laceration or thrombosis, while acceleration force can cause renal parenchymal and vascular injury with the impact of fractured fragments of the ribs.[1] We encountered three high energy accidents, with one patient falling from height and two having MVA, rendering suspicion for kidney injury.

Blunt trauma to the kidney can result in occlusion of the renal artery due to compression caused by the vertebral body, which damages the intimal layer of the arteries and leads to thrombosis.[8] Deceleration causes stretching and tearing of the intima, which is less elastic than the medial and adventitial layers.[9] Remaining intimal flaps initiate thrombotic flap formation, spreading rapidly to the distal.[9]

The previous report stated the relative injury rate from renal trauma is 1.4:1 to 2:1 between the left and right sides.[10] This is partly due to the shorter left renal artery in which the angulation and traction occur at 1–2 cm from the point where the renal artery is bifurcated from the aorta. In addition, the left kidney is more mobile than the right kidney.[11] An association between kidney injury and other visceral organs was also found. Splenic and liver-related injuries were noted in a patient with a vascular injury to the left and the right kidney, respectively.[12] We report two cases of left RAT with splenic injury, and one case of right RAT with hepatic injury.

According to the Advanced Trauma Life Support (ATLS) guideline, managing patients with unstable hemodynamics adheres to basic resuscitation.[13] Patients with blunt abdominal trauma in multiple injuries that is potentially life-threatening need to be carefully assessed. Most patients with RAT are associated with other injuries that could cause the patient unstable. Treating the source of hemodynamic instability to prevent

mortality takes precedence over improving renal function.[4]

Indications of imaging for renal trauma include visible hematuria, unseen hematuria with one episode of hypotension, history of rapid deceleration trauma and/or history of other related trauma, sharp/penetrating trauma, and physical examination with suspicion of renal trauma such as low back pain, flank injury, rib fracture, abdominal distension and/or mass or tenderness.[14] CT scan is a specific modality to confirm the diagnosis of renal artery injury.[4] Decreased contrast filling to the renal artery and subsequent renal vascularity, abnormal enhancement of the kidneys, retrograde opacification of renal veins and inferior vena cava, and irregularity of renal artery lumen in the occlusion area with contrast extravasation are the typical CT findings of RAT.[13,15] Both intravenous pyelography (IVP) and ultrasonography can provide important information about the vascular and parenchymal integrity when a CT scan unable to performed.[16]

The latest European Association of Urology (EAU) guideline on Urological trauma recommends NOM for stable renal trauma patients with no active bleeding. On the other hand, Grade 5 vascular injury is an absolute indication for exploration[7]. RAT is considered renal trauma grade [4.17] Managing grade IV renal injuries is challenging since low-grade injuries rarely require intervention, and grade V injuries typically require renal exploration.[18] The management of RAT is still debatable.

The experience of each center in managing this rare type of injury is still limited. Opinions are divided between immediate surgical revascularization and observation, whereas immediate revascularization rarely improves renal function if the ischemic process has exceeded 12 hours due to a delay in diagnosis. Based on previous studies, the critical time to improve renal function is less than 2-3 hours. This window will usually elapse before the revascularization procedure is finished.[4] Surgical revascularization is recommended for bilateral RAT or a solitary kidney.[19-20] However, revasculari-zation procedures also increase the risk of renovascular hypertension.[21]

According to Sangthong et al., conservative treatment is recommended in patients with RAT secondary to blunt abdominal trauma because the risk of complication does not exceed that of revascularization. Therefore only 8.7% of patients with RAT underwent surgical treatment reported in a study by Sangthong et al.[6] Unilateral thrombosis with normal contralateral renal function was discovered in our cases. However, the window period for revascularization had passed for all patients, so NOM was preferred. Complete bed rest, close observation, laboratory tests, and serial imaging were advised for the patients. A previous study by McCombie et al. (2014) has also supported recommendations regarding the conservative approach if the patient does not need immediate intervention for bleeding or a urine leak. However, the need for delayed intervention should be routinely assessed.[18]

The outcome of NOM for the patients was satisfactory. Follow-up is required for creatinine levels and blood pressure monitoring, in accordance with the previous case series study.[4] Blood pressure was measured to anticipate the development of renovascular hypertension, which can occur mainly in the first year after trauma.[18] Nephrectomy is indicated if renovascular hypertension and renal abscess are developed.[6] During the follow-up of the first patient, complications such as renovascular hypertension, renal abscess, persistent pain, or abnormal creatinine levels were negative. Unfortunately, imaging examination of the first case after a one-year follow-up revealed atrophy of the right kidney, which became non-functional. Patients with RAT may exhibit renal atrophy and fibrosis due to infarction of the renal parenchyma.[22]

In one-month follow-up of the second and third cases, no complications and renal function abnormalities in these patients were observed. The most important limitations of this study are lack of follow-up and reliable documentation of complications. The ongoing COVID-19 pandemic becomes the drawback, which causes loss of follow-up in 2 subjects in this study.

CONCLUSION

In conclusion, early detection of RAT is critical for treatment to reach effective results. Most patients with RAT have other life-threatening injuries, so managing these injuries is a priority. Conservative management is recommended for the treatment of unilateral RAT with good contralateral renal function. However proper follow-up is also needed to assess the final clinical outcome of the affected kidney. Close follow-up is essential to monitor complications such as renovascular hypertension.

REFERENCES

1. Erlich, T. & Kitrey, N. D. Renal trauma: the current

best practice. Ther Adv Urol. 2018: 1-9.
2. Patel, P., Hospital, S. C. & Duttaroy, D. Management of renal injuries in blunt abdominal trauma Original Article Management of renal injuries in blunt abdominal trauma. 2014.
3. Austin, J. & Rajkumar, G. The diagnosis and management of renal trauma. J Clin Urol. 2017.
4. Jawas, A. & Abu-Zidan, F. M. Management algorithm for complete blunt renal artery occlusion in multiple trauma patients: Case series. International Journal of Surgery. 2008; 6: 317–322.
5. Singh, O., Gupta, S. S., Sharma, D., Lahoti, B. K. & Mathur, R. K. Isolated renal artery thrombosis because of blunt trauma abdomen: report of a case with review of the literature. Urol Int. 2010; 86: 233–238.
6. Sangthong, B. et al. Management and hospital outcomes of blunt renal artery injuries: analysis of 517 patients from the National Trauma Data Bank. J Am Coll Surg. 2006; 203: 612-617.
7. Kitrey, N. et al. EAU Guidelines on Urological Trauma. European Association of Urology. 2022.
8. Nugraha, H. G. et al. Post-traumatic renal artery thrombosis secondary to blunt abdominal trauma: A rare case report. Bali Medical Journal. 2021; 10: 587–590.
9. Szmigielski, W., Kumar, R., al Hilli, S. & Ismail, M. Renal trauma imaging: Diagnosis and management. A pictorial review. Polish Journal of Radiology. 2013; 78: 27–35.
10. Lee, J. T. & White, R. A. Endovascular management of blunt traumatic renal artery dissection. Journal of Endovascular Therapy. 2002; 9: 354–358.
11. Li, G., Gao, Y., Li, P. & Li, M. Renal Artery Thrombosis Secondary to Blunt Abdominal Trauma with Accessory Renal Artery Supplying the Kidney Segment: A Rare Case Report. Urol J. 2015; 12: 2044–2045.
12. Harper, K. & Shah, K. H. Renal trauma after blunt abdominal injury. J Emerg Med. 2013; 45: 400–404.
13. Shoobridge, J. J. et al. Contemporary management of renal trauma. Rev Urol. 2011; 13: 65.
14. Kitrey, N. D. et al. EAU guidelines on urological trauma. European Association of Urology. 2021. p. 1–50.
15. Ahmed, Z. et al. Renal artery injury secondary to blunt abdominal trauma – Two case reports. Pol J Radiol. 2016; 81: 572–577.
16. Santucci, R. A. et al. Evaluation and management of renal injuries: consensus statement of the renal trauma subcommittee. 2004.
17. Van der Wilden, G. M. et al. Successful Nonoperative management of the most severe blunt renal injuries: A multicenter study of the research consortium of new england centers for trauma. JAMA Surg. 2013; 148: 924–931.
18. McCombie, S. P. et al. The conservative management of renal trauma: A literature review and practical clinical guideline from Australia and New Zealand. BJU International. 2014; 114: 13–21.
19. Alnahhal, K. I., Jarmi, T., Hakaim, A. G. & Farres, H. Renal artery revascularization using the inferior mesenteric artery as an inflow source with a long-term follow-up. Journal of Vascular Surgery Cases, Innovations and Techniques. 2021; 7: 223–225.
20. Tillou, A. et al. Renal vascular injuries. Surgical Clinics of North America. 2021; 81: 1417–1430.
21. Jackson, D. G. et al. Kidney Salvage with Renal Artery Reconstruction after Blunt Traumatic Injury. Case Rep Urol. 2020; 1–4.
22. Jeong, Y., Kim, S., Lee, H. & Sim, J. Atypical Low-Signal-Intensity Renal Parenchyma: Causes and Patterns. 2002.