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Unfortunate Hypovolemic Shock Following Ruptured Brachialis Artery Injury Due to Sharp Injury: A Case Report

Putu Chandra Wibawa[1*], IGAB Krisna Wibawa[2], Ida Bagus Budiarta[2], AA Gde Agung Anom Arie Wiradana[1]

[1]General Surgeon, Division of Vascular and Endovascular Surgeon, Faculty of Medicine, Udayana University, Udayana University General Hospital

[2]Division of Vascular and Endovascular Surgery, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Denpasar, Indonesia

E-mail: chandra.wibawa@unud.ac.id; anomwiradana@unud.ac.id; igabkrisnawibawa@yahoo.com; budiartaidabagus@gmail.com

*Corresponding Author: Putu Chandra Wibawa; Chandra.wibawa@unud.ac.id

ABSTRACT

Background: In general, trauma can be interpreted as the cause of a disability or cause of death of a person. Trauma can be broadly divided into blunt trauma, sharp trauma, firearm trauma, and chemical trauma. Sharp trauma is defined as an injury to the body due to contact with a sharp object. Despite being relatively uncommon, injuries to the arteries of the upper extremity can be serious and have a significant impact on the outcome of trauma. The upper extremity's brachial artery is the most frequently injured arteries. These injuries make up roughly 28% of all vascular injuries. ***Case presentation:*** A patient presented to the emergency unit of Prof. Ngoerah Hospital with severe pain in the left lower arm following an accident involving broken glass during glass installation. The patient reported an inability to lift the hand, numbness at the fingertips, and weakness in the left hand. A diagnosis of brachial artery rupture was made. ***Discussion:*** Brachial artery injuries, although uncommon, require immediate attention due to their potential impact on limb function and overall outcomes. Prompt and effective management is crucial to enhance tissue repair, minimize infection risk, and improve survival rates. A thorough secondary survey is essential to identify and address any additional injuries or complications. ***Conclusion:*** Timely treatment and comprehensive assessment of brachial artery injuries can significantly improve patient outcomes. Early intervention can enhance the chances of successful tissue repair, reduce the risk of infection, and lower the likelihood of complications, ultimately increasing the survival rate.

Keywords: ruptured brachialis artery; sharp injury; hypovolemic shock.

INTRODUCTION

In general, trauma can be interpreted as the cause of a disability or cause of death of a person. Trauma can be broadly divided into blunt trauma, sharp trauma, firearm trauma, and chemical trauma. Sharp trauma is defined as an injury to the body due to contact with a sharp object. In general, wounds caused by sharp objects can be clearly seen in the conditions around the wound, which is found to be a flat wound with a sharp wound angle accompanied by a tissue bridge. This is a very typical characteristic of sharp trauma and can be a differentiator from trauma caused by blunt objects, firearms, and chemicals [1]. Trauma can be interpreted as the third largest cause of disability to death worldwide, especially fourth decade of life in developing nations. Estimated from 2000 to 2020, there was an increase of 83%, and in 2002, there were 5 million people who died from trauma, 90% of whom occurred in developing countries. The consequences of trauma can be physical, psychological, and financial disabilities.

Despite being relatively uncommon, injuries to the arteries of the upper extremity can be serious and have a significant impact on the outcome of trauma. The upper extremity's brachial artery is the most frequently injured arteries. These injuries make up roughly 28% of all vascular injuries. The degree of ischemia that results from injury to the brachial artery is dependent on whether the injury is in the vicinity or distance from the deep arm. Unless there is severe nerve injury, all brachial artery injuries can be treated effectively [2,3]. The median nerve runs parallel to the brachial artery. Radial and ulnar nerves run parallel to segments of the brachial artery.

The brachial artery commonly causes nerve injuries in addition to all other vascular injuries of the upper extremity. Sharps trauma, such as knives, broken glass, or other sharp instruments, can cause direct injury to blood vessels. When a sharp object strikes the brachial artery, the integrity of the blood vessel can be compromised, leading to massive bleeding. Symptoms typically include severe bleeding that is difficult to stop, intense pain, and swelling in the area of injury. In some cases, loss of consciousness or hypovolemic shock may occur due to significant blood loss [4].

Prompt treatment of a brachial artery rupture is essential to prevent serious complications, including loss of arm function, amputation, or even death. Initial treatment typically involves controlling bleeding with direct pressure or tight dressings, followed by surgery to repair the damage to the blood vessel. The use of hemostatic agents and embolization are also considered invasive treatments to more effectively stop the bleeding. Although sharps-force brachial artery rupture is a rare injury, it is often seen in industrial accidents, domestic accidents, or in the context of physical violence. Therefore, a good knowledge of the symptoms, early management, and appropriate medical intervention is essential for medical personnel in handling cases like this [5,6].

CASE REPORT

The patient came to the emergency unit of Prof. Ngoerah Hospital on 9 September 2024 who was a referral patient from Kasih Ibu Hospital with complaints of severe pain in the left lower arm after the patient was hit by broken glass while working on installing glass. Complaints were accompanied by the inability to lift the hand a numb sensation at the tips of the fingers of the left hand, and weakness. Other complaints such as decreased consciousness, nausea, and vomiting were not found. Before coming to the emergency unit of Prof. Ngoerah Hospital, the patient received the following therapy: loading intravenous fluid drip ringer lactate 1500 cc; loading hydroxyethyl starch; paracetamol flash 1 gram intravenously; pantoprazole injection 40 mg intravenously; ondansetron injection 8 mg intravenously; bandage on the hand; and tranexamic acid 500 mg intravenously.

On physical examination, the patient appeared to be in a weak general condition with GCS E3V5M6, Vital signs present: Blood pressure 80/40 mmHg; heart rate 102x/min; SpO2 99% (in the administration of a face mask 6 liters/minute); axillary temperature 36.8oC and visual analogue scale (VAS) 5/10. In general, the status found is as follows: eyes appear anaemic; The heart and lungs are within the normal range when examined. The abdominal area is within the normal range when examined. When examining the left upper extremity, they discovered extensive vulnus laceratum measuring 15x25 cm accompanied by active bleeding, edema, cold impression, the vascular status of the radial artery, ulnaris artery, and brachial artery not palpable, with ankle-brachial index 0.92 (borderline), and on examination of saturation of the 5 fingers showed -/-/-/-/-. Then the laboratory results were obtained as follows:

TABLE 1: Patient's laboratory examination result before surgery on 9 September 2024.

Parameter	Result	Reference range	Unit
Haematology			
Haemoglobin	9.3	13.0 – 17.0	g/dL
Leukocyte	36.34	5 – 10	10^3/µL
Thrombocyte	383	150 – 400	10^3/µL

FIGURE 1: Patient's arm condition when coming to the Prof. Ngoerah Central General Hospital.

After the patient received a series of examinations, the patient was diagnosed with hypovolemic shock et causa rupture of the left brachial artery accompanied by anaemia. Then the patient will undergo a vascular repair cito exploration operation.

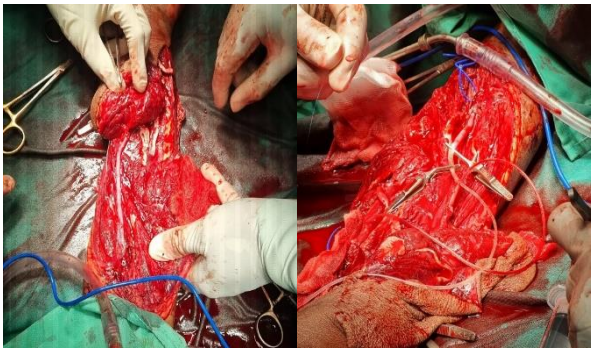

FIGURE 2: The condition of the patient's arm during the operation.

After the patient underwent vascular repair exploration surgery, the patient appeared conscious while still under the influence of the anaesthetic with

vital signs: blood pressure 122/86 mmHg; heart rate 130x/minute; respiration rate 18x/minute; SpO2 98% (in the administration of a face mask 6 liters/minute); and axillary temperature 36.5oC. In general, the status found is as follows: eyes do not appear anaemic; The heart and lungs are within the normal range when examined. The abdominal area is within the normal range when examined.

When examining the left upper extremity, they discovered the postoperative wound was treated using a backslab, and no seepage was found, vascular status of the radial artery, ulnaris artery, and brachial artery was palpable, and on examination of saturation of the 5 fingers was showed 100%/100%/100%/100%/100%. Then the laboratory results were obtained as follows:

TABLE 1: Patient's laboratory examination result after surgery on 9 September 2024.

Parameter	Result	Reference range	Unit
Haematology			
Haemoglobin	4.8	13.0 – 17.0	g/dL
Leukocyte	24.21	5 – 10	10^3/µL
Thrombocyte	226	150 – 400	10^3/µL
Blood Chemistry			
Partial Thromboplastin Time	15.3	10 – 12	Second
International Normalized Ratio	1.38		
Active Partial Thromboplastin Time	32.2	35 – 45	Second
Serum Glutamic Oxaloacetic Transaminase	10	0 – 37	U/L
Serum Glutamic Pyruvate Transaminase	11	0 – 42	U/L
Renal Physiology			
Blood urea nitrogen	18	15 – 45	mg/dL
Serum Creatinine	1	0.6 – 1.3	mg/dL
Estimated Glomerulus Filtration Rate	91.77	>90	mg/mmol
Electrolyte			
Natrium	137	135 – 145	mmol/L
Kalium	6.7	3.5 – 5.0	mmol/L

FIGURE 3: The condition of the patient's arm after the operation.

After the patient is treated in the room, the patient receives the following therapy: intravena fluid drip NaCl 0.9% 1500 ml/24 hours; intravena ceftriaxone 2 gr every 24 hours; treat the wound every 2 days if there is seepage; heparin bolus 4000 IU; heparin maintenance 15.000 IU/24 hours; fentanyl 500 mcg; ketamine 30 mg in 20 ml NaCl 0.8 ml/hours; intravena paracetamol 1 g/8 hours; intravena ibuprofen 400 mg/8 hours; intravena omeprazole 40 mg/12 hours; midazolam target titration RASS-2; tranexamic acid 1 g/8 hours; vit K 10 mg/24 hours; calcium gluconate 1g/8 hours; metronidazole 500 mg/8 hours. After the patient was treated for 9 days in the treatment room (17 September 2024) and was declared able to be treated as an outpatient, the following laboratory results were obtained:

TABLE 3: Patient's laboratory examination result after surgery on 17 September 2024.

Parameter	Result	Reference range	Unit
Haematology			
Haemoglobin	9.8	13.0 – 17.0	g/dL
Erythrocytes	3.40	4.5 – 5.9	
Leukocyte	6.67	5 – 10	10^3/µL
Thrombocyte	313	150 – 400	10^3/µL
Hematocrit	30.1	41.0 – 53.0	%
Blood Chemistry			
Partial Thromboplastin Time	14.3	10 – 12	Second
International Normalized Ratio	1.04	0.9 – 1.1	
Active Partial Thromboplastin Time	28.7	35 – 45	Second

Parameter	Result	Reference range	Unit
Electrolyte			
Natrium	137	135 – 145	mmol/L
Chlorida	103.3	94 – 110	mmol/L
Kalium	4.38	3.5 – 5.0	mmol/L

DISCUSSION

Shock is a medical emergency characterized by the failure of blood circulation to maintain adequate perfusion to body tissues, resulting in impaired cellular metabolism and organ damage. Shock can occur in various forms, including hypovolemic shock, which is most commonly caused by haemorrhage. One of the main causes of hypovolemic shock is injury to a large blood vessel, including rupture of the brachial artery. The brachial artery is the main blood vessel in the arm that carries blood to the upper arm, elbow, and hand. Injury to this artery, due to trauma such as a sharp object, can cause massive bleeding leading to a decrease in circulating blood volume, thus triggering shock [7].

Despite being relatively uncommon, injuries to the arteries of the upper extremity can be serious and have a significant impact on the outcome of trauma. The upper extremity's brachial artery is the most frequently injured arteries. These injuries make up roughly 28% of all vascular injuries. The degree of ischemia that results from injury to the brachial artery is dependent on whether the injury is in the vicinity or distance from the deep arm. Unless there is severe nerve injury, all brachial artery injuries can be treated effectively [2].

Brachial artery rupture due to sharp force trauma causes a direct tear in the blood vessel, resulting in massive blood loss outside the vessel. The brachial artery has a large blood flow capacity because it is the main vessel in the arm, so even a small blood loss can cause a significant decrease in blood volume. This decrease in blood volume causes hypovolemia, a condition of lack of body fluids that can cause decreased tissue perfusion and a drastic decrease in blood pressure, as in this case, the patient came with a low blood pressure of 80/40 even though he had been given intravenous fluid loading of 1500 cc of Ringer's lactate and the haemoglobin examination found the patient's Haemoglobin was 9.3 g/dL. In hypovolemic conditions, the body attempts to maintain blood circulation through compensatory mechanisms. One of the initial responses is vasoconstriction (narrowing of blood vessels) and increased heart rate to maintain blood pressure. Although these mechanisms can help for some time, continued blood loss without adequate replacement can lead to impaired tissue oxygenation and eventually damage to vital organs. If shock is not treated promptly, more severe refractory shock can occur and even cause death [8].

In determining the next action after resuscitation and secondary survey for patients with brachial artery rupture injuries must be done as soon as possible. In patients with hard signs of arterial injuries, surgery must be performed immediately, if there are soft signs of arterial injuries, doppler ultrasonography must be performed first. When the results show positive, surgery can be performed immediately or angiography can be performed and continued with endovascular surgery. If the results show negative, observation will be carried out first, followed by angiography, when the results are positive, endovascular surgery is performed, and when the results show negative, observation is carried out [6,9]. In this patient, the patient came with clear signs of arterial injury as seen in Figure 1 which is reinforced by the finding that the saturation of the patient's five fingers decreased to 0%. So, the next action that can be taken is to operate immediately.

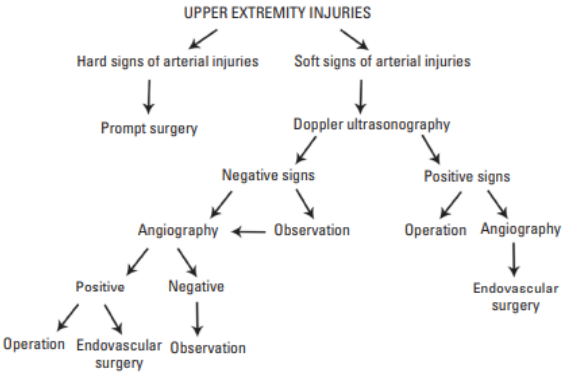

FIGURE 4: The algorithm diagnostic and therapy for arterial injuries of upper extremity [9].

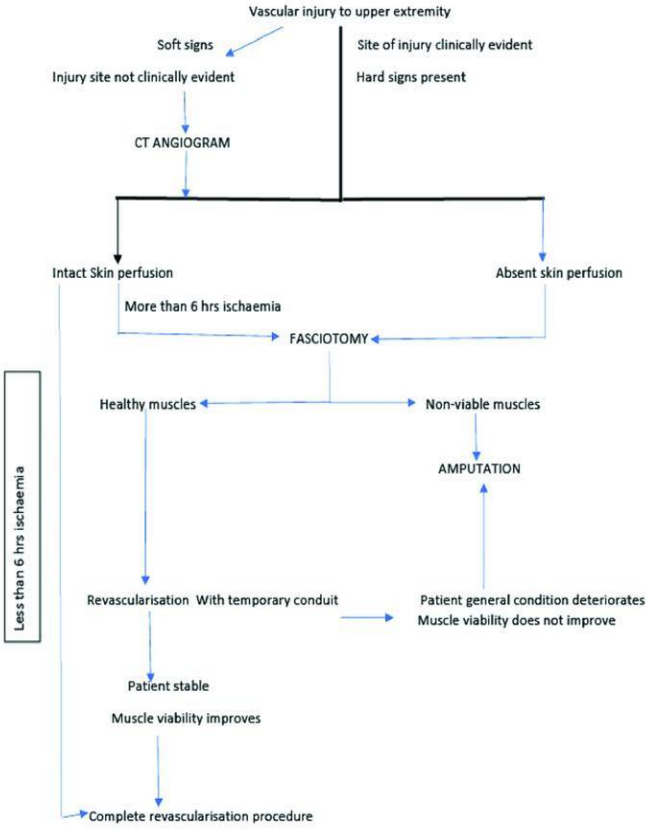

FIGURE 5: Another algorithm of emergency therapy for arterial injuries of upper extremity [10].

The treatment for peripheral arterial injuries has remained unchanged with open surgery. The surgical repair of brachial artery injuries can be achieved through various methods, including side-to-side repair, resection with end-end anastomosis, and interposition grafts (typically in the saphenous vein). The use of end-to-end anastomosis is recommended when it can be performed without any strain or damage to vital collateral vessels. A saphenous vein interposition graft is the next most practical option, as it has a higher patency rate and is more infection-resistant than synthetic gestures [5,11]. It is important to bear in mind that arteries are subjected to a golden period of tissue ischemia lasting 6-8 hours when treated. Arterial repair will result in less tissue damage and systemic effects, as the patient is treated earlier. These are directly related to the severity and duration of striated muscle ischemia. When treatment is carried out outside the golden period, it can threaten the survival of the patient's limbs due to prolonged ischemia which can become necrosis, infection can occur in the ischemic tissue to sepsis and endanger the patient's life [2,6]. In this patient, the therapy given was less than 6 hours, as evidenced by the very good post-operative results, starting from the return of perfusion of all fingers to normal, there were no signs of infection, namely no visible seepage or pus, increased blood pressure to normal, and blood components began to increase.

CONCLUSIONS

Treatment and prompt treatment of brachial artery injuries, and a good secondary survey can increase the chances of better tissue repair, reduce the likelihood of infection, increase survival rate, and reduce the risk of other complications.

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