



IMPROVISED TEMPORARY INTRALUMINAL SHUNT USING A FOLEY CATHETER FOR THE INITIAL MANAGEMENT OF A COMPLEX POPLITEAL VASCULAR INJURY: A CASE REPORT AND REVIEW OF THE LITERATURE

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ABSTRACT

Introduction: popliteal vascular injuries constitute a surgical emergency associated with a high risk of limb ischemia and limb loss. Temporary intravascular shunts allow rapid restoration of blood flow and may be particularly useful in damage control surgery and when transfer to a higher-level trauma center is required. However, commercially available vascular shunts may not be readily accessible in resource-limited hospitals.

Case Presentation: we present the case of a young male patient who sustained severe trauma to the posterior aspect of the left knee after being struck by a rock during mining activity in the Ecuadorian Amazon. The patient was admitted with significant bleeding and signs of hemodynamic compromise and was urgently taken to the operating room. Surgical exploration revealed a complex popliteal vascular injury with segmental vessel loss and extensive soft-tissue damage. Because a commercial vascular shunt was unavailable and stabilization was required before transfer, a modified Foley catheter was used as a temporary intraluminal shunt. The catheter was inserted into the proximal and distal segments of the injured vessel and secured with sutures. Following shunt placement, distal pulses were detected and hemodynamic stability improved. The patient was subsequently transferred to a higher-level center, where definitive vascular reconstruction was performed using an autologous saphenous vein graft. The limb was preserved, and the subsequent clinical course was favorable.

Conclusion: the use of a Foley catheter as a temporary intraluminal shunt may represent an exceptional damage-control option for patients with severe vascular trauma treated in resource-limited settings. Although it should not be considered a substitute for vascular shunts specifically designed for this purpose, its immediate availability may help temporarily maintain limb perfusion and facilitate transfer for definitive vascular reconstruction.

KEYWORDS: Vascular Trauma; Popliteal Injury; Temporary Intravascular Shunt; Foley Catheter; Damage Control Surgery; Resource-Limited Settings.

INTRODUCTION

Vascular injuries of the extremities represent a surgical emergency because of the risk of exsanguinating hemorrhage, acute ischemia, and limb loss. Among these injuries, popliteal vascular injuries are associated with a significant risk of complications and limb loss and therefore require timely diagnosis and treatment to optimize the chances of limb salvage(1).

In patients with complex vascular trauma, damage control surgery is an important strategy when definitive vascular reconstruction cannot be performed immediately. In this setting, temporary intravascular shunts can maintain distal perfusion, limit the duration of ischemia, and facilitate patient transfer to a specialized center for definitive treatment(2,3).

Although commercially available devices have been specifically designed for this purpose, they may not be readily available in rural or resource-limited hospitals. In such circumstances, improvised alternatives using materials available in the operating room have been described as temporary measures within the principles of damage control surgery. However, evidence regarding these strategies remains limited and is based primarily on case reports and small case series(4).

We present the case of a patient with a traumatic popliteal vascular injury secondary to a work-related accident, initially managed with an improvised temporary intraluminal shunt fashioned from a modified Foley catheter, with the aim of maintaining limb perfusion and facilitating stabilization and

subsequent transfer to a higher-level center for definitive vascular reconstruction.

METHODS

A clinical case report was conducted involving a young male patient with a traumatic popliteal vascular injury who was initially treated at a resource-limited hospital in the Ecuadorian Amazon. The case was reconstructed based on the available clinical information, the recollection of the participating surgical team, and intraoperative photographic documentation. Because the event occurred approximately five years ago and the complete original medical records are not currently available, some procedural details, including the exact length of the vascular injury, the size of the catheter used, and the precise intervals until definitive vascular reconstruction, are reported as approximate when applicable.

To contextualize the management approach, a narrative review of the literature was conducted focusing on extremity vascular trauma, vascular damage control surgery, temporary intravascular shunts, and the use of improvised devices in resource-limited settings. A search of biomedical databases was performed using terms related to *temporary intravascular shunt*, *vascular trauma*, *popliteal vascular injury*, *improvised vascular shunt*, *Foley catheter*, and *damage control vascular surgery*. Systematic reviews, observational studies, clinical practice guidelines, and relevant case reports were prioritized.

The analysis focused on the indications and applications of temporary intravascular shunts in extremity vascular trauma, improvised alternatives when commercially available devices are not accessible, and comparisons between cases reported in the literature and the characteristics of the present case.

CASE PRESENTATION

A young male patient, a mine worker, sustained a work-related accident after being struck by a large rock in the posterior aspect of the left knee. The trauma resulted in an open injury of the popliteal region associated with a complex vascular injury and significant hemorrhage.

Figure 1. Traumatic injury of the left popliteal region with extensive involvement of the surrounding soft tissues.



Source: Authors.

The patient was immediately transferred to the emergency department of a secondary-level hospital in the

Ecuadorian Amazon, arriving approximately 30 minutes after the accident. On arrival, he had persistent bleeding and signs of hemodynamic compromise associated with blood loss. He was therefore urgently taken to the operating room, and surgery was initiated shortly after admission.

Surgical exploration revealed a popliteal vascular injury with segmental loss of the vessel, estimated at approximately 5 cm, associated with extensive surrounding soft-tissue injury. Copious irrigation, debridement of devitalized tissue, and initial hemorrhage control were performed.

Because definitive vascular reconstruction could not be performed at the initial hospital and a commercial vascular shunt was unavailable, an improvised temporary intraluminal shunt was fashioned using a Foley catheter, which was recalled to be approximately 16 Fr in size. The catheter was introduced into the proximal and distal segments of the injured vessel and secured with sutures to maintain its position and restore vascular flow. The procedure lasted approximately one hour.

Figure 2. Intraoperative image showing the popliteal vascular injury and placement of a temporary intraluminal shunt fashioned from a modified Foley catheter.



Source: Authors.

Following shunt placement, distal pulses were detected and the patient's hemodynamic stability improved. After completion of the damage-control procedure, the patient remained hospitalized while transfer to a higher-level center was arranged.

Approximately 24 to 48 hours later, the patient was transferred to a hospital with vascular surgery capabilities, where definitive vascular reconstruction was performed using an autologous saphenous vein graft. The patient subsequently returned to the referring hospital for postoperative management and rehabilitation. The clinical course was favorable, with preservation of the limb and satisfactory functional recovery.



DISCUSSION

Vascular injuries of the extremities constitute a surgical emergency in which rapid restoration of blood flow is essential to limit ischemia and increase the likelihood of limb salvage. Temporary intravascular shunts (TIVS) have been increasingly incorporated into the management of vascular trauma as a damage-control strategy, particularly when definitive vascular reconstruction cannot be performed immediately or when the patient requires transfer to a higher-level trauma center. A systematic review including 21 studies and 1,280 patients found that TIVS were used predominantly for lower-extremity vascular injuries and, in most cases, as part of a damage-control strategy(1).

The main benefit of a temporary shunt is to provide rapid revascularization, thereby reducing ischemic time while allowing for patient stabilization, management of associated injuries, or transfer to a center with definitive vascular reconstruction capabilities. In a contemporary series of civilian vascular trauma, patients treated with TIVS had a shorter time to revascularization and a higher likelihood of limb salvage. The authors emphasized that temporary shunting may be particularly useful when the patient requires evacuation or when definitive vascular reconstruction must be delayed(5).

In the present case, the use of a temporary shunt was prompted by circumstances that differed from those typically encountered in major trauma centers. The patient was initially treated at a hospital located far from a referral center and presented with a complex popliteal vascular injury, significant hemorrhage, and segmental loss of the vessel. The lack of immediate access to a commercially available vascular shunt, combined with the need to maintain limb perfusion until definitive reconstruction could be performed, justified the use of an improvised device. This scenario represents one of the situations in which TIVS may be particularly valuable—not necessarily as a substitute for definitive repair, but rather as a bridging measure that allows additional time to be gained without compromising limb viability(6).

The available evidence also suggests that the use of a shunt as a damage-control strategy does not necessarily result in a higher risk of shunt-related complications when prolonged dwell time is required because of clinical circumstances. In a prospective multicenter study of 66 patients with arterial injuries, shunt-related complications occurred in approximately 9% of cases, with no significant difference between shunts placed for damage-control indications and those used for other indications. These findings support the use of temporary shunting as a reasonable strategy when the clinical situation precludes immediate definitive vascular reconstruction(3).

The use of readily available devices as alternatives to commercially manufactured vascular shunts has previously been described in trauma and resource-limited settings. In particular, Papan et al. described the intravascular placement of a Foley catheter for temporary control of femoral arterial hemorrhage during the transfer of a trauma patient. However, in that case, the Foley catheter was primarily used as a hemorrhage-control device, whereas in the present case it was used as a temporary intraluminal conduit between the proximal and distal segments of an injured popliteal vessel, with the aim of maintaining vascular continuity and limb perfusion until definitive reconstruction could be performed(7,8).

Although previous reports have described the use of Foley catheters in emergency vascular situations, the available literature remains limited and consists primarily of case reports. The present case describes a different application of this concept, using a modified Foley catheter as a temporary intraluminal shunt for a complex popliteal vascular injury in a hospital without access to commercially available vascular shunts, followed by transfer to a higher-level center for definitive reconstruction using a saphenous vein graft.

The case reported by Papan et al. represents the most directly relevant precedent to our experience. Both cases involved the use of a Foley catheter as a temporary vascular adjunct in the setting of trauma and limited resource availability, as well as the need for transfer to a higher-level center. However, important differences exist in the application of the device. Whereas Papan et al. used the Foley catheter primarily for temporary control of femoral arterial hemorrhage, in our case it was used as an intraluminal bridge between the proximal and distal ends of the injured vessel. Furthermore, our patient sustained a popliteal vascular injury secondary to crush trauma and subsequently underwent definitive reconstruction with a saphenous vein graft, with successful limb preservation(8).

The choice of material used for a temporary shunt depends primarily on its availability, diameter, rigidity, and ability to maintain vascular lumen patency without causing additional injury. Although commercially manufactured devices are specifically designed for vascular shunting, improvised shunts using intravenous tubing, feeding tubes, chest tubes, and other plastic conduits readily available in emergency settings have also been described. In resource-limited environments, these devices may serve as salvage alternatives when the absence of a commercially available shunt could otherwise prolong limb ischemia(9).

The literature also emphasizes that the primary goal of temporary shunting is not to replace definitive vascular repair, but rather to rapidly restore blood flow and gain time to complete resuscitation, perform debridement of injured tissues, manage associated injuries, or transfer the patient to a center with definitive vascular reconstruction capabilities. This principle is particularly relevant to the present case, as the patient was initially treated at a hospital located far from a specialized center and was subsequently transferred for definitive reconstruction with a saphenous vein graft(5).

In this context, the clinical course of the present patient is consistent with the fundamental objective of vascular damage-control surgery: preserving limb viability during the interval between initial management and definitive repair. In a contemporary series of 53 patients with complex lower-extremity vascular trauma, the use of temporary shunts was associated with shorter time to revascularization and a higher likelihood of limb salvage. Although these findings cannot establish causality because of the observational nature of the study, they support the concept of using a temporary shunt as a bridging strategy in selected patients(5).

A particularly relevant aspect of our case is the resource-limited setting. Recommendations regarding temporary shunting specifically recognize the need for this strategy when trauma occurs in austere environments or when patients require transportation to a specialized center. Under such circumstances, surgical resourcefulness may be necessary,



provided that the device used can maintain adequate luminal continuity and can be rapidly deployed. The present case illustrates this principle through the use of a Foley catheter that was immediately available in the operating room(9).

The use of an improvised device, however, is not without risks. The literature identifies shunt displacement, thrombosis, intimal injury, and flow obstruction as the main potential complications. Therefore, these devices should be regarded as temporary salvage measures, and definitive vascular reconstruction should be performed as soon as the patient's physiological condition and available resources permit. In the present case, the presence of distal pulses following shunt placement, followed by definitive reconstruction with a saphenous vein graft, suggests that the device provided effective temporary vascular continuity and maintained limb perfusion during the bridging period(10).

A recently published report describes a comparable concept in a resource-limited setting: a patient with brachial artery transection was initially managed with an improvised shunt fashioned from an intravenous infusion set and subsequently underwent reconstruction with a saphenous vein graft. This case demonstrates that the principle of using readily available materials to temporarily maintain perfusion may be applicable when dedicated vascular devices are unavailable. However, our case presents a relevant distinction in that a Foley catheter was used as a temporary intraluminal conduit for a popliteal vascular injury. To the best of our knowledge, we did not identify an equivalent clinical application of a Foley catheter for this purpose in our initial literature search(11).

This report has several limitations inherent to its case-report nature. The available data correspond to an event that occurred several years ago, and some perioperative parameters, including the exact length of the vascular defect, the precise caliber of the catheter used, and the exact time to definitive reconstruction, are not currently available in the documentation reviewed by the authors. Therefore, these details should be interpreted as approximations based on the available clinical records and the treating team's recollection. Furthermore, because this is a single case, it is not possible to establish the safety or efficacy of using a Foley catheter as a temporary vascular shunt or to extrapolate these findings to other patients. The available literature on improvised shunts is also limited and consists predominantly of case reports and observational series(1,12).

Nevertheless, this case demonstrates a practical application of the principles of vascular damage-control surgery in a resource-limited setting. Immediate placement of a temporary intraluminal conduit allowed limb perfusion to be maintained during patient stabilization and transfer until definitive vascular reconstruction with a saphenous vein graft could be performed. Temporary shunts are specifically intended to provide rapid revascularization and serve as a bridge to definitive repair, particularly when patient transfer is required or when local circumstances preclude immediate reconstruction (1,13).

In this context, the use of a Foley catheter readily available in the operating room may be considered an exceptional salvage strategy rather than a substitute for vascular devices specifically designed for this purpose. Its use should be reserved for situations in which no suitable alternative is available and the primary goal is to temporarily maintain

vascular flow and prevent prolonged limb ischemia. Contemporary literature continues to demonstrate increasing use of temporary shunts in trauma, while also recognizing the lack of standardized protocols and the limited availability of high-quality comparative evidence(3).

A recent report of a patient with a brachial artery injury provides a particularly comparable example: the authors used an intravenous infusion system as a temporary vascular shunt in a resource-limited setting and subsequently performed definitive reconstruction with a saphenous vein graft. This precedent supports the principle of using readily available materials to establish temporary vascular bypass when a commercially manufactured device is unavailable. Our case adds a different experience by describing the use of a Foley catheter as a temporary intraluminal conduit for a popliteal vascular injury, followed by definitive reconstruction with a saphenous vein graft and successful limb preservation(11).

CONCLUSIONS

In resource-limited hospitals where commercially available vascular shunts may not be accessible and transfer to a specialized center is required, an improvised temporary intraluminal shunt may serve as a damage-control strategy to maintain perfusion of an injured limb. This case describes the use of a modified Foley catheter as a temporary vascular bridge in a complex popliteal vascular injury, followed by definitive reconstruction with a saphenous vein graft and successful limb salvage. Although this approach should not be considered equivalent to devices specifically designed for vascular shunting, it may represent an exceptional salvage alternative when no other suitable option is immediately available.

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CONFLICT OF INTEREST

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