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Cardiovascular surgeon's perspective of the iatrogenic vascular injuries in gynecologic surgery

Jinekolojik cerrahideki iyatrojenik vasküler yaralanmalarda kalp ve damar cerrahının bakış açısı

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Background: This study aims to define basic parameters and to propose certain attitudes towards the management of such patients.

Methods: Data of the 18 gynecologic surgery patients (mean age 54.4±3.2 years; range 45 to 63 years) who were intraoperatively consulted to vascular surgery for vascular trauma between January 2003 and December 2012 were retrospectively analyzed. All patients had undergone a previous surgical procedure in the same surgical site.

Results: The vascular structures injured were the iliac arteries in eight patients, iliac veins in eight patients and inferior vena cava in two patients. The mean length of intensive care unit and hospital stays were 2.7±1.2 and 7.1±1.6 days, respectively. One patient died postoperatively.

Conclusion: We believe that favorable results for this potentially lethal complication can be achieved with individual management strategies tailored in accordance with certain principles.

Key words: Complication; gynecologic surgery; iatrogenic disease; intraoperative; vascular surgery.

Amaç: Bu çalışmada, bazı temel parametreler tanımlandı ve bu hastaların tedavisine yönelik belirli yaklaşımlar önerildi.

Çalışma planı: Ocak 2003 ve Aralık 2012 tarihleri arasında vasküler travma nedeniyle ameliyat sırasında vasküler cerrahiye konsülte edilen 18 jinekolojik cerrahi hastasının (ort. yaş 54.4±3.2 yıl; dağılım 45-63 yıl) verileri retrospektif olarak incelendi. Hastaların tümü önceden aynı bölgeden ameliyat geçirmiş hastalardı.

Bulgular: Yaralanan vasküler yapılar sekiz hastada iliyak arter, sekiz hastada iliyak ven ve iki hastada inferior vena kava idi. Ortalama yoğun bakımda ve hastanede kalış süreleri sırasıyla 2.7±1.2 ve 7.1±1.6 gün idi. Ameliyat sonrası bir hasta kaybedildi.

Sonuç: Bazı tedavi ilkelerine bağlı kalarak her hasta için özel şekillendirilmiş tedavi stratejisi ile bu ölümcül komplikasyonun tedavisinde olumlu sonuçlar alınabileceğine inanıyoruz.

Anahtar sözcükler: Komplikasyon; jinekolojik cerrahi; iyatrojenik hastalık; ameliyat sırası; damar cerrahisi.

Iatrogenic vascular injury, which constitutes 48-75% of all vascular injuries, is a potentially lethal complication of many different surgical specialties. Among these, gynecological surgery has a specific subset of cases with unique properties that are worth considering separately. Vascular complications associated with this type of surgery are among the most serious because they immediately place the patient's prognosis at risk. This is of great importance because these complications are not only responsible for problems related to medical litigation but also the significant morbidity and consequent mortality associated with them. Most of what has been written about vascular injuries during gynecological surgery has involved laparoscopic cases, but the mechanism of vascular injury is usually different in gynecological surgery cases.[1-4] Reports about iatrogenic vascular injuries[5-7] have reported on populations that consist mostly of femoral artery

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puncture site injuries. Thus, such articles usually focus on this specific patient population, which is quite different from the gynecological and/or oncological patient subpopulation. A recent report about vascular injuries during cancer surgery does include gynecological cases, but since the population also featured colorectal, orthopedic, thyroid, and urological cancer surgery cases, it is too heterogeneous to be representative.[8] Not much data exists regarding iatrogenic vascular injuries during gynecological operations. Surgery for gynecological cancer often requires extensive dissection in the retroperitoneal space, which may be distorted by cancer that has metastasized to the lymph nodes or invaded adjacent structures. Therefore, injuries to the pelvic veins and arteries are common and may result in significant intraoperative blood loss and hemorrhage. The surgeon must be prepared for this eventuality and have the skill and the tools at his disposal to stop the bleeding.

PATIENTS AND METHODS

The charts of the 18 patients (mean age 54.4±3.2 years; range 45 to 63 years) who required an intraoperative consultation with the vascular surgery department because of emergency vascular trauma between January 2003 and December 2012 were retrospectively reviewed. The patients with non-gynecological, procedure-related vascular complications, minor venous injuries repaired by non-vascular surgeons, and catheter-related injuries were not included in the study. The patients' age, location of the injury, method of diagnosis, treatment modalities, and postoperative course were recorded, and the demographic data, reason for the gynecological oncological procedure, and the type of repair are summarized in Table 1. In all of these cases, the primary surgeon spotted a major vascular trauma, resulting in the need for the consultation, and the same cardiovascular surgeon performed all of the vascular repairs.

The on-call cardiovascular surgery team was consulted intraoperatively with regard to the gynecological surgery patients with iatrogenic vascular injuries. All had undergone a previous surgical procedure close to the operative area. The diagnosis for all of the patients was made intraoperatively because of massive hemorrhagia, either with or without a sudden deterioration in blood pressure.

The two most commonly injured vascular structures were the iliac arteries and veins with eight injuries each. Apart from this, the inferior vena cava (IVC) was injured in two patients. All of the vascular injuries occurred during blunt or sharp dissection, and bleeding was the presenting symptom in all of the patients. In addition, they were suffering from gynecological malignancies, and in three of the patients, the tumor had infiltrated the vascular structures (iliac veins).

Of the eight iliac vein injuries, six were to the common iliac vein and two were to the internal iliac vein. Six were repaired primarily while two required

Table 1. Demographic data

Patient no	Age	Pathology	Vessel	Type of repair
1	55	Metastatic ovarian tumor	Internal iliac vein	Ligation
2	52	Metastatic ovarian tumor	Common iliac artery	Graft
3	55	Endometrium Carcinoma	Common iliac vein	Repair
4	48	Myoma	Common iliac artery	Graft
5	57	Metastatic ovarian tumor	Internal iliac vein	Ligation
6	63	Endometrium Carcinoma	External iliac artery	Repair
7	66	Metastatic ovarian tumor	Common iliac artery	Repair
8	41	Tubal surgey	Common iliac vein	Repair
9	52	Myoma	Common iliac artery	Repair
10	58	Endometrial hyperplasia	Inferior vena cava	Repair
11	43	Abnormal uterin bleeding	Common iliac vein	Repair (patch)
12	55	Myoma	External iliac artery	Graft
13	48	Myoma	Common iliac vein	Repair
14	69	Metastatic ovarian tumor	Common iliac vein	Repair
15	51	Myoma	External iliac artery	Repair
16	44	Chronic pelvic pain	Common iliac artery	Repair
17	68	Metastatic ovarian tumor	Inferior vena cava	Repair
18	63	Endometrial hyperplasia	Common iliac vein	Repair (patch)

patch venoplasty, with a Dacron venoplasty patch (Jotec, Hechingen, Germany) being the preferred choice. None of the injuries to the iliac veins required ligation of the vein or graft interposition. The arterial injuries were to the common iliac arteries in five patients and the external iliac arteries in three others. Five of these injuries were suitable for primary repair; however, three required a graft interposition, and polytetrafluoroethylene (PTFE) grafts (Jotec, Hechingen, Germany) were used for these patients. The IVC injuries were repaired primarily in one patient and with patch venoplasty in the other.

Complete vascular reconstruction was the aim of the procedure, and this was achieved in all of the cases. Furthermore, the patients received low-molecular-weight heparin (LMWH) during their hospital stay. In addition, arterial and venous patency was evaluated by a magnetic resonance angiogram (MRA) and a duplex scan postoperatively before discharge.

RESULTS

The mean red blood cell requirement was 1.8±0.6 units during the operative and postoperative periods, and the mean lengths of intensive care unit (ICU) and hospital stays were 2.7±1.2 and 7.1±1.6 days, respectively. Perioperative mortality was 6.25% with only one postoperative death, with the cause being multisystem organ failure. There was also one postoperative amputation due to graft thrombosis in the arterial group, and this patient was treated with a PTFE graft interposition because of a common iliac artery injury. Additionally, venous occlusion was found in the external iliac vein in one patient who had undergone repair of the common iliac vein via patch venoplasty. This patient was symptomatic with mild edema and was treated medically with an intermittant pneumotic compression device (Kendall SCD, Tyco Healthcare, United Kingdom) and compression stockings.

DISCUSSION

The increasing incidence of iatrogenic vascular injuries is problematic since they are usually associated with a higher mortality and morbidity than penetrating and blunt trauma.[7] A previously proposed explanation for this is that the older patient population is more vulnerable and is usually subject to iatrogenic injuries. Practitioners from many subspecialties can cause these iatrogenic injuries, and they can have many different etiologies. Cancer surgery generally carries a certain risk of arterial and venous injuries because of the hostile, distorted anatomy. Other factors that increase the technical difficulty in the dissection and identification of tissue planes are previous operations, tumor recurrence, previous radiation therapy, and chronic inflammatory changes.[1-6] Furthermore, gynecological surgery usually requires extensive dissection around the major vascular structures, and these patients are usually subject to a number of operations on this same region, which results in increased adhesions and a higher risk of trauma each time.

If the previous data on iatrogenic vascular injuries (Table 2) is used as a reference, even though it was not restricted to gynecological surgery cases, our mortality and morbidity rates seem encouraging. One of the reasons for the rather favorable outcome can be attributed to the pivotal role played by the prompt consultation with the vascular surgery team once the primary surgeon encountered the injury. The experience of the primary surgeon and the cooperation between the vascular surgery and gynecology teams was important. Another vascular surgery team previously had a similar observation regarding iatrogenic venous injuries in that most of the blood loss occurred before the vascular surgeons were involved in the cases.[6] However, it is difficult to draw any scientific conclusions from these observations. Chapron et al.[3] documented that the vascular surgery department is not always consulted in iatrogenic vascular injuries, and any attempt by an inexperienced surgeon to use clamps to control the bleeding would not only increase the blood loss but also complicate the vascular repair by further lacerating the vessel. This probably occurs more often in venous injuries than arterial injuries. In contrast, there is data which implies that gynecologists can handle vascular complications themselves with acceptable mortality and morbidity. Nezhat et al.[9] presented a case series involving laparoscopic gynecology in which the vascular surgery department was consulted in only one of the eight cases and found that the bleeding site had been repaired laparoscopically in four of the patients. However, it should be kept in mind that the mechanism and extent of the injury in laparoscopic surgery for benign disease and reoperative gynecological surgery can be quite different. Salman et al.[10] reported on a series of 123 gynecological cases in which nine patients with vascular injuries, which included IFC perforation, were repaired without the assistance of vascular surgeons. The exact indication of when to consult a vascular surgeon is difficult to assess because the lack of standard measurements regarding the extent of the injury makes it irrelevant to compare data from

Table 2. Mortality and morbidity in the relevant literature

Author	Mechanism of injury	Vascular structures involved	Number of patients with vascular injuries	Gynecology patients	Deep venous thrombosis	Amputation	Mortality
			n	n	n	n	%
Chapron et al.[3]	Iatrogenic	Non-selective	17	17	0	0	11.8
Nezhat et al.[9]	Iatrogenic	Non-selective	8	8	1	0	12.5
Zamir et al.[10]	Non-selective	Venous	46	0	4	2	0
Oderich et al.[6]	Iatrogenic	Venous	40	6	1	0	18
Giswold et al.[5]	Non-selective	Arterial	85	Unknown	Unknown	Unknown	7.1
Barbosa Barros et al.[1]	Iatrogenic	Non-selective	5	5	0	0	0
Oktar[8]	Iatrogenic	Venous	24	1	2	1	16.7
Rudström et al.[7]	Iatrogenic	Non-selective	888	Unknown	Unknown	7	4.9

different case series. An important principle for the gynecologists to bear in mind is that an unsuccessful attempt to repair a vascular injury usually makes it more difficult to repair. Rudström et al.[7] found that controlling the bleeding with direct digital pressure or sponge compression appeared to be safer than using clamps, as had previously been the norm. They also noted that this allows time for resuscitation of the volume that has been lost, which is most likely a major cause of mortality. Currently, meticulous dissection of the vessel for proximal and distal control is the aim since planning for the repair requires a clear understanding of the extent of the damage. Once the damaged portion of the vessel is clamped proximally and distally, the rest of the operation can be carried out in a more elaborate manner.

Complete vascular reconstruction is the ideal scenario since it is counterproductive to ligate the iliac vessels or vena cava.[1] Our experience suggests that most of the vascular injuries encountered during gynecological procedures can be repaired primarily. Patch angioplasty should be considered whenever primary repair is not possible or plausible. Our data indicates that this approach can work with venous injuries better than with arterial injuries. The venous injuries in our study were controlled early enough and were not extensive, so a graft interposition was not necessary. In addition, different series have determined that graft interpositions are probably superior to simple ligation of the veins[1,4,6,8] for complete vascular reconstruction and that autogenous spiral or panel grafts[11] and PTFE grafts,[8] can also be used. However, it is not possible to comment on the data presented in those series as it does not sufficiently relate to gynecological cases. On the other hand, for the arteries in those series,[1,4,6,8] all of the injuries that were not suitable for primary repair were treated with a graft interposition. One possible explanation for this is that the more superficial anatomical position of the iliac arteries compared with the veins may make them more prone to postoperative intraabdominal adhesions. Thus, whenever an arterial trauma cannot be controlled by primary repair, it is usually too extensive to be repaired by patch angioplasty and requires a graft interposition. Another point to consider is the surgeons' bias toward complex repairs of veins, which is notorious for causing thrombosis.[11] However, perhaps choosing a graft interposition for an artery rather than for a vein should be more common. Because our data was retrospective, and the decisions were made during an emergency, we were not able to answer these questions (about the choice of repair) definitively.

For the postoperative follow-up, the main point to consider is the patency of the repaired vessel. Anticoagulation with LMWH seems reasonable for all vascular repairs in this specific iatrogenic trauma patient population. In addition, a recent review recommended that cancer patients who have had major abdominal/pelvic operations and currently have impaired mobility should consider extended-duration prophylaxis (up to 28 days), preferably with LMWH, for venous thromboembolism. However, it is reasonable to assume that this type of vascular repair would further increase the risk of venous thromboembolism in these patients.

This study had certain limitations. The emergency nature of the vascular injuries that were studied did not allow for any specific background knowledge regarding the mechanism of the injuries and the traumatic events to be known until the vascular surgeon reached the operation site. Furthermore, the limited amount of literature related to this specific patient group and the

small number of patients in this series also restricted the ability to compare different strategies and define the most rational strategy. This was also true because of the varied anatomy of the involved vasculature, which mandated a patient-specific strategic planning.

In the context of iatrogenic vascular surgeries, gynecological cases primarily have unique properties in patients who are old and fragile. The anatomic field of the surgery is also in close proximity to the major vascular structures, which are vulnerable to injury because of lymph node dissections that these patients frequently have to undergo and extensive adhesions due to the many reoperations. The first step in the management of these cases undoubtedly relies on the instant decision-making of the primary surgeon to consult a vascular surgeon without delay whenever he is not able to take care of the bleeding himself. Expert repair of such injuries by a cardiovascular surgeon is mandatory to minimize the risk of complications. Furthermore, treating these injuries requires the knowledge of vascular surgical techniques as well as a familiarity with the dissection and exposure of a wide variety of vascular structures. The cardiovascular surgeon's strategy, although tailored specifically for every case, follows a main pathway to control the bleeding as soon as possible and allows for some time for fluid resuscitation, dissection of the injured vessel to diagnose the extent of the damage and elaborate planning of the surgery with the aim of complete vascular repair. We believe that this type of strategy combined with careful postoperative follow-up can lead to favorable results in this patient population.

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