Femoral Triangle Sepsis in Dialysis Patients

Frequency, Management, and Outcome

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Prosthetic devices for dialysis access sometimes have to be implanted in the groin. Infections are frequent there, and when they occur their management is influenced by the patients' need for continued dialysis, and often, by the presence of concomitant diseases. We report implantation of 161 dialysis access devices of various types, all utilizing the femoral vessels. Twenty-seven femoral triangle injections eventually occurred. Both the approach to their treatment and outcome were influenced by mode of presentation, localized infection being most favorable, and fever without localized signs least. The compromise surgical procedures made necessary by the patients' precarious medical status were successful in most instances but overall mortality was 18%, and the amputation rate 22%.

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SEPSIS IS RARE in reconstructive vascular surgery. However, when vascular surgical techniques are used to obtain angioaccess for chronic hemodialysis, infection is not only more common but its treatment may differ from that usually employed for infected vascular prosthetics. It has been known for years that infections are frequent in chronic renal failure[1,2] and also that their most likely source is the patient's access device. Dobkin et al.[3] recorded 0.15 significant bacteremic episodes per year per chronic dialysis patient. More than two-thirds were attributed to access site infection. A high sepsis rate is understandable; dialysis access devices by necessity violate surgical principles. For example, vascular prostheses that have been placed subcutaneously are regularly entered by percutaneous needles, providing repeated opportunity for bacterial innoculation. If external arteriovenous shunts are used instead, tubing connected to vessels is brought through the skin, forming a permanent path for potential infection. Our experience[4] has shown the failure rate from sepsis to be much higher for all types of devices when they are placed in the groin rather than the arm.[4] The femoral triangle is never the first choice for dialysis access, but sometimes must be used. When infections occur there, two characteristics of dialysis patients influence its treatment.

One is the absolute necessity that dialysis continue. Sometimes peritoneal dialysis can be substituted for hemodialysis, but not always. It may be necessary to continue to use a septic prosthesis because there is no other way to dialyze the patient. Secondly, in some, the overall medical status increases the risk of major vascular surgical procedures. These considerations often dictate compromises in management either to allow continued use of the access device, or to permit replacement or repair to be performed with local anesthesia.

The difficulty of treating septic synthetic arterial prostheses has been recognized since their introduction.[5] The most desirable approach, extraanatomic bypass, was described by Shaw and Baue:[6]

> Ideal surgical treatment of an infected arterial reconstruction . . . involves:
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> Isolation and defunctioning of the infected segment by division of the uninfected artery or graft proximally and distally through clean incisions.
>
> Exclusion of the ends of the defunctioned segment from these clean fields.
>
> Restoration of vascular continuity by bypass graft around the septic region.
>
> Standard treatment of the infected segment by drainage, removal of foreign body, etc., after the clean incisions have been closed and protected.

With just one exception, we have never been able to achieve these goals in dialysis patients with sepsis

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of the femoral triangle. Clinical realities have dictated that the first surgical procedure be a compromise. This report describes our approach to this problem and the results.

Materials and Methods

Clinical records of patients maintained on chronic hemodialysis by means of a secondary access device were reviewed. Secondary devices are those used when simpler, preferred techniques, the Brescia-Cimino fistula[7] and the Quinton-Brescia shunt,[8] have been tried and failed. There are several types. One is the Thomas femoral shunt (TFS), a velour-covered tube cemented to a fabric patch.[9] A pair of these is used, the patch of one sutured into a femoral arteriotomy, of the other into an incision in the femoral vein. The tubes are brought out through stab wounds and connected externally. All the other secondary devices are some type of graft forming a subcutaneous, puncturable arteriovenous fistula. The greater saphenous vein (SVG) was the first material used. Numerous types of prosthetics have been employed since, including the Sparks mandril graft (SMG), bovine graft (BG), and expanded microfibrillar polytetrafluorothylene (PTFE).

In the nine year period ending January 1, 1978, 381 secondary access devices were implanted into 192 patients with endstage renal disease, being maintained by chronic hemodialysis. Of these, 161 were placed in the femoral triangle. All operations were performed by one of two surgeons (Morgan or Tilney). Antibiotics were used before, during and after implantation. The skin was shaved just before the operation and prepared with an iodophor. The procedures were done under magnification and an effort made to achieve highest standards of tissue handling, hemostasis and ligation of divided lymphatics. Twenty-five episodes of infection which required surgical treatment occurred. Two patients with infected prostheses, transferred from other hospitals, are included in outcome but not incidence data.

Results

Table 1 shows the number and types of devices implanted and the number of femoral triangle infections resulting. No infections were recognized in the first postoperative month. Eleven of 27 episodes of sepsis (41%) occurred in the second and third months after implantation; the rest at scattered intervals up to four years.

Clinical Presentation

The presentation and early course of these infections fell into three distinguishable categories, as follows:

TABLE 1. *Vascular Access Procedures in the Leg*

Device	Number	Infections	Per Cent Infected*
TFS	39	13	34
SVG	84	8	9.6
BG	7	2	28
SMG	17	2	12
PTFE	14	2	14
Total	161	27	17

* Two devices (1 TFS, 1 SVG) were implanted at another hospital; these patients are not included in the population base used to calculate percentage of infection.

Systemic sepsis. Fever, chills, or bacteremia without an obvious source were the first manifestation of infection in seven patients. When examined initially, the access sites showed no signs of inflammation; however, in all of them, a pseudoaneurysm appeared later at the arterial suture line. An unexplained septicemia is not rare in dialysis patients, appropriate antibiotics were begun while a search was made for the cause.

Aneurysm. A pulsating groin mass was the first evidence of infection in eight patients. Five subsequently developed fever, the other three were never febrile despite positive cultures.

Local infection. Almost half the patients presented with obvious local signs of infection, being either an abscess around a graft or shunt tubing, an infected hemotoma, or cellulitis surrounding a skin erosion that exposed the graft. Fever was least common in this group. It occurred in only three patients.

Management

Initial surgical therapy followed one of four approaches (Table 2). All patients received intravenous antibiotics.

Local treatment. When a localized abscess or septic skin lesion involved part of the graft, but not the arterial suture line, the involved length was excised and replaced with a new segment tunneled through adjacent normal tissue. Patients were maintained on dialysis by using the unresected part of the original graft until the new subcutaneous tunnel and incisions healed. A variation was employed for an abscess around the percutaneous velour covered tubing of the Thomas femoral shunt. The infected portion was resected, new tubing anastomosed to the remaining stump, and then brought out through a fresh stab wound. Both of these procedures differ in principle from the extraanatomic bypass of general vascular surgery in that the new prosthetic is placed in a surgical field which includes the septic site and is undoubtedly contaminated to some degree.

Artery reconstituted in contaminated field. When infection involved most of the graft but not the arterial

TABLE 2. *Type of Initial Treatment and Outcome*

First Surgical Treatment	Number	Hemostasis Successful Sepsis Controlled	Secondary Hemorrhage	Amputation	Death
Drainage of focal sepsis and/or local bypass	6	5	1	0	0
Artery reconstituted in contaminated field	12	7*	5	2	2
Artery ligated in septic field	8	5	3	4	2
Extraanatomic bypass	1	0	0	0	1

* Includes three flush-ligated saphenous vein grafts.

suture line, the entire device was removed and the artery reconstructed by lateral suture with monofilament material. A vein patch was used when necessary. The incisions were closed over a catheter for antibiotic installation, and a small drain.

Artery ligated in septic field. If visible infection extended to the arterial anastomosis or if an artery was too friable to hold sutures, it was transfixed, doubly ligated, divided, and allowed to retract. The incisions were closed, drained, and irrigated.

Extraanatomic bypass. In a single case, an ileopopliteal bypass through the obturator foramen was done and followed by arterial ligation, wound debridement and packing.

The femoral vein was reconstituted in all instances to minimize edema, and theoretically, enhance arterial flow. There was no secondary bleeding from veins; no information about late venous patency is available.

Bacteriology

All of the first wound cultures grew a single organism, although a mixed flora sometimes appeared later after antibiotic therapy. The initial isolate, presumably the causative organism, was more commonly gram negative than gram positive (Table 3). A larger number of gram negative infections occurred in TFS (9 of 13), than in subcutaneous grafts (6 to 15), suggesting that the usually gram negative flora resident around this percutaneous device may become responsible for significant infection.

Outcome

As noted, the first surgical treatment of infected prostheses in most instances fell short of the ideal of extraanatomic bypass. Nevertheless, in a number of instances a satisfactory result was achieved. Table 2 compares the type of treatment with outcome. The goal of treatment is control of sepsis and bleeding with survival of both limb and patient; it is reached most frequently when the infection is local, the arterial suture line is not involved, and the treatment is drainage and local bypass through adjacent healthy tissue. In five out of six persons managed this way, the prosthesis was salvaged for continued use. In the other, secondary bleeding led to its loss.

TABLE 3. *Results of First Positive Wound Culture*

Staphylococcus	
coagulase positive	11
coagulase negative	1
Proteus sp.	10
E. Coli	2
Pseudomonas sp.	2
Enterobacter	1

Removal of the prosthesis followed by arterial reconstitution was successful in seven of 12 patients; in the remainder, secondary hemorrhage required ligation, leading to amputation in two patients.

It will be noted that primary ligation did not guarantee control of bleeding. Religation at a higher level was necessary in three of eight persons. One such patient was treated by obturator bypass, but later died of widespread sepsis. The other two deaths were caused by myocardial infarction.

The patients are further subdivided to explore the relationship between presentation, treatment and outcome (Table 4). The groups, too small for statistical analysis, suggest that the most unfavorable form of presentation is fever, followed by development of a false aneurysm after a period of antibiotic therapy. In these patients attempts to debride and reconstitute the artery were almost never successful and even primary ligation failed in 2 of the 3 patients where it was tried.

The final level of arterial ligation, in the 15 patients who required it, ranged from the superficial femoral to, in one instance, the common iliac (Table 5). Two later reconstructions were done to relieve ischemic symptoms, not for limb preservation. In six, it was elected to accept amputation because the patients' precarious medical status precluded attempting reconstruction.

Discussion

The data presented emphasize some of the differences between sepsis that occurs in and around dialysis access devices and sepsis after arterial reconstruction. They do not show treatment which falls short of extraanatomic bypass to be either better or worse than the ideal. Some patients and some devices have been salvaged, in other instances, arterial ligation has allowed limbs to be traded for lives.

Infection is the major problem in the maintenance of access devices. In arterial reconstruction for peripheral vascular disease, the incidence of infection varies with the site and material, but can be expected to be less than 5% or 6% when a prosthesis is used and an incision is made in the groin.[10] The sepsis rate for dialysis devices can be as great as 34% (Table 1). The difference is doubtless explicable by some combination of intraoperative contamination, immunologic compromise in the uremic, seeding during transient bacteremias and extension of local infections over the graft. Intraoperative contamination is possible, but probably infrequent, as it is in routine vascular surgery. The absence of recognized infection in the first postoperative month speaks for this, although it is acknowledged that some wound infections, with antibiotic suppression, may be manifested later. Many of these infections occurred in the second and third months after implantation, too late for all of them to have originated in the operating room, and suggesting greater susceptibility of the incompletely healed devices to bacterial innoculation by needle puncture. It has been observed, also, that grafts are more vulnerable to blood-bourne infection early after their placement,[11] their resistance to bacteremic seeding increasing with time. Thus, it seems likely that most infections result from using the grafts, not implanting them.

Our present approach to management of groin sepsis in the dialysis patient was evolved from the experience tabulated herein. Systemic antibiotic therapy is initiated in all. Then, if the infection is localized along the length of the graft the affected segment is bypassed and excised. This works most of the time; when it does not it is usually because of spread of infection to the new graft and it is still possible to excise the whole prosthesis and reconstitute the artery. When infection is too extensive for segmental excision, but the arterial suture line still not grossly involved, the graft can usually be removed and the artery repaired.

Patients admitted for systemic sepsis without evidence of graft infection are a more difficult problem. Evaluation may disclose a source of sepsis unrelated to the access device; its unwarranted removal is undesirable. Some recover with antibiotic therapy without a diagnosis ever being made. It is conceivable that some infected grafts are sterilized by antibiotics, but the number, if any, is not known. It is only certain that if localized findings do eventually occur in this group, the failure rate is high even when the site of the arterial suture line is free of obvious infection. Our poor results have caused us to favor primary ligation as the first procedure in this patient subgroup, and even ligation may not be successful on first attempt.

TABLE 4.

Presentation	First Treatment	Number	Number Successful
Systemic sepsis	Local	1	0
	Reconstitution	4	1
	Ligation	3	1
	Bypass	0	0
Aneurysm	Local	0	0
	Reconstitution	3	2
	Ligation	5	5
	Bypass	1	0
Local	Local	5	5
	Reconstitution	5	4
	Ligation	0	0
	Bypass	0	0

The situation is different when infection presents itself as a false aneurysm without preliminary fever and antibiotic treatment. In the dialysis patient a pseudoaneurysm in the groin is usually septic. All were in this series, unlike the ordinary vascular patient where the majority have a mechanical origin and are sterile. Conservative treatment is more successful in this group and the decision to ligate or reconstitute can be based on the appearance of the femoral artery at the time of operation.

In all groups it has been possible, and we believe desirable, to defer the decision between amputation and extra-anatomic bypass for a few hours to a few days after a ligation, when one is done, without making an irrevocable commitment to amputation. Many patients tolerate ligation with no sequellae, or only late ones that can be dealt with electively. As is well known, the expectation of amputation following arterial ligation at various sites taken from published military experience may be higher than in civilian practice.[12] In our patients, the amputation rate ranged from one in four ligations of the superficial femoral artery to four in eight ligations of the common femoral.

TABLE 5. *Results of Arterial Ligation*

Level	Number	Limb Preserved: With Later Reconstruction	Limb Preserved: Without	Amputation
Iliac	3	0	2	1
Common femoral	8	1	3	4
Superficial femoral	4	1	2	1

Prevention is obviously better than treatment. The high incidence of infection in the groin has confirmed original impressions that this site should not be used if any other is available. Increasing use of axillary and subclavian veins for recipient vessels has made it less often necessary to place grafts in the femoral triangle. When a graft must be implanted there, the greater saphenous vein is used, if available and suitable, as sepsis occurs less frequently and is easier to treat.

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