

Oblique Groin Incision for Endovascular Repair of Abdominal Aortic Aneurysms

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ABSTRACT

Purpose: Groin incision for access to the femoral artery is necessary for stent graft repair of abdominal aortic aneurysm (AAA). However, lymphatic and infectious complications can occur during wound healing after surgery. A vertical incision traditionally is used, but a new oblique incision technique has the potential to reduce complications. We report our results from AAA stent repairs performed via oblique incisions at our center for a 33-month period.

Methods: Data for 134 consecutive patients undergoing elective stent repair of asymptomatic infrarenal AAA performed by 2 cardiovascular surgeons at a single center from July 1, 2000, to March 31, 2003, were gathered for analysis. Wound complication percentages for infections, paresthesias, sepsis, and seroma were calculated.

Results: In 134 patients, a total of 278 incisions were made. Reasons for extra incisions included improving catheter entry angle (5 cases), tunneling for vascular tapes (3 cases), and initial approach too low (2 cases). The percentages were, however, calculated on a per-patient basis. Thirty-day analysis revealed a 0% infection rate, 4.7% incidence of paresthesias, 2.38% rate of wound seroma, and 0% wound sepsis rate.

Conclusion: Because of the nonexistent infection rate and low wound complication rate, our data supports the use of oblique groin incisions for stent repair of asymptomatic infrarenal AAA.

INTRODUCTION

Vertical incisions across the groin crease traditionally have been made for access to femoral vessels in revascularization and open cannulation procedures. Perioperative problems with these wounds are common as the result of lymphatic and

infectious etiologies [Wengrovitz 1990, Reifsnnyder 1992, Hunt 1997]. These complications threaten underlying grafts, may require complex plastic surgical procedures for coverage, extend hospital stay, create significant additional expense, and, in some cases, place the affected extremity and/or patient at risk. The literature on infrainguinal revascularization is replete with reports regarding the occurrence of such complications and their frequencies. However, the etiology and frequency of incisional complications after groin dissection for endovascular procedures are less clear. To determine the incidence of wound complications, we analyzed our experience at a single center using oblique groin incisions for femoral access for endovascular graft insertion of a variety of US Food and Drug Administration–approved devices.

PATIENTS AND METHODS

One hundred thirty-four consecutive patients were prospectively followed after endovascular stent-graft exclusion of aortic aneurysms at Riverside Methodist Hospital, Columbus, Ohio. All patients had oblique, parainguinal groin skin incisions used for access to the femoral arteries. Intravenous prophylactic antibiotics were administered to every patient prior to skin incision. An oblique incision was made 2 fingerbreadths superior to the groin crease, parallel to the inguinal ligament, and directly over the femoral pulse. The subcutaneous tissues were divided transversely with electrocautery, and lymphatic and venous branches were divided between metallic clips as they were encountered down to the level of the fascia lata. The fascia overlying the femoral artery was opened vertically to avoid division of the parainguinal lymphatics, and the common femoral artery was exposed. The inguinal ligament was uniformly preserved and, after mobilization of its inferior edge and use of a self-retaining Adson cerebellar retractor, could be gently lifted superiorly for more proximal access to the external iliac artery. This maneuver essentially provided access to the distal pelvic vasculature and thus made available a larger, typically less atherosclerotically challenged access conduit. Proximal arterial control was usually obtained by using an elastic tape to encircle the external iliac artery just above the undivided origins of the inferior epigastric and circumflex iliac arteries. The latter 2 branches served as helpful constraints for pre-

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Table 1. Demographics*

	Stent Grafting (n = 134)	P
Mean age, y	71.6	NS
Age (range)	47-91	NS
Male sex	89.5%	NS
Smoking, present	22.4%	NS
Smoking, former	33.6%	NS
COPD	32.1%	NS
Hypertension	70.2%	NS
History of myocardial infarction	31.3%	NS
Cerebrovascular accident	6.7%	NS
Diabetes mellitus, oral medication	3.4%	NS
Diabetes mellitus, insulin	2.2%	NS
Congestive heart failure	11.2%	NS
Renal insufficiency	9.7%	NS
Hyperlipidemia	44.0%	NS
Peripheral vascular disease	30.6%	NS
Coronary artery disease	50.0%	NS
Alcohol use	5.2%	NS
ASA risk category		
I-II	4.2%	NS
III	75.8%	NS
IV	20.0%	NS
Mean aneurysm size, cm	5.1	
Range of size, cm	4.8 to 7.5	NS
Total incisions, n	278†	

*NS indicates not significant; COPD, chronic obstructive pulmonary disease; ASA, American Society of Anesthesiologists.

†Three 2-mm counterincisions for cannula-tourniquet tunnel, 2 too low, 5 counterincisions for improved cannula angle.

venting caudal migration of the proximal control ligature. The catheters and device sheaths were inserted directly into a transverse femoral arteriotomy, or, in markedly obese patients, a small tunnel incision was made in the anterior thigh inferior to the main wound to allow passage of large-diameter catheters into the femoral artery at a gentler angle, preventing catheter kinking or vessel injury. The closure in all patients was done in 3 layers with braided polyglycolic acid suture. The skin was closed with a subcuticular suture technique.

In this study, groin wound complications prior to discharge were defined as hematoma, reexploration for bleeding, arterial dissection/destruction necessitating vascular repair, and incision conversion secondary to inadequate exposure. Complications addressed at the 30-day follow-up examination were defined as cellulitis requiring antibiotic treatment, subcutaneous purulence, lymphoceles, and extremity paresthesias.

RESULTS

From July 1, 2000, to March 31, 2003, 134 consecutive patients at Riverside Methodist Hospital in Columbus, Ohio, underwent endovascular placement of aortic stent-grafts through oblique groin incisions. The demographics are shown in Table 1 and the blood loss, anesthesia, and surgical

Table 2. Shed Blood, Anesthesia, and Procedure*

	Stent Grafting	P
Estimated blood loss, mean, mL	379	
Estimated blood loss, range, mL	30-2200	NS
Anesthesia, general/spinal	86%/14%	NS
Complex arterial repair	1.5%	NS

*NS indicates not significant.

procedures performed in Table 2. One hundred thirty patients received bifurcated stent-grafts, and 4 patients received aortouniiliac stent-grafts with femoral-femoral artery bypasses, giving a total of 278 groin wounds. Eight “tunneling” incisions were made, and 2 (0.72%) of the incisions were revised after the initial attempts were too low. Fourteen (10.5%) of the patients were women, and 120 (89.5%) were men. The average age was 71.6 years. Forty-one (42%) of the patients had a history of peripheral vascular occlusive disease, 75 (56%) were smokers, and 21 (15.6%) were diabetic. Thirteen (9.7%) of the patients had renal insufficiency or end-stage renal failure. Four (3%) of the patients had undergone previous dissections in the ipsilateral groin. No single preoperative or perioperative characteristic was significantly associated with a groin wound complication according to univariate and multivariate analyses.

The complication rates are shown in Table 3 and the discharge status in Table 4. No patient needed reexploration for

Table 3. Complications*

	Stent Grafting (n = 134)	P
Hematoma	4.76%	NS
Pseudoaneurysm	0.0%	
Incision conversion	0.0%	
Limb thrombosis	2.38%	NS
Myocardial infarction	0.79%	NS
Retroperitoneal bleed	0.79%	NS
Dysrhythmia	1.59%	NS
Ileus	0.79%	NS
Dissection	0.79%	NS
Incisional hernia	0.0%	
Infection (purulence)	0.0%	
Cellulitis	2.98%	NS
Cerebrovascular accident	0.79%	NS
Renal complications	0.79%	NS
Paralysis	0%	
Paresthesia	1.49%	NS
Perforation	0.79%	NS
Sepsis	0%	
Seroma	2.38%	NS
Intention to treat/abandon	0.79%	NS
Congestive heart failure	0.79%	NS
Late conversion	1.5%	NS
Conversion to open repair	0.0%	

*NS indicates not significant.

Table 4. Discharge Status*

	Stent Grafting (n = 134)	P
Home	82.84%	NS
Home health	6.72%	NS
Skilled/extended care	5.22%	NS
Died	0.75%	NS
30-day follow-up	100%	

*NS indicates not significant.

bleeding. Two patients needed arterial repair of access trauma (vein patch in 1 patient and Dacron patch in 1 patient). Patient follow-up was 100% at 30 days. Lymphatic wound complications developed in 5 of 278 groin wounds for an incidence of 3.73% (per patient). Three patients needed operative drainage of lymphocele after percutaneous drainage failed. Six (4.47%) of the patients in this series were found to have incisional hematomas. All patients were conservatively treated and did not need transfusion, and the hematoma did not affect the length of hospital stay. Two (1.49%) of the patients reported medial thigh paresthesias at their 30-day follow-up visits. No patient developed purulence or sepsis related to the wound. However, 4 (2.98%) of the patients developed wound cellulitis, which resolved after a course of empiric oral antibiotic therapy.

DISCUSSION

Catheter-based treatment of abdominal aortic aneurysms is aimed primarily at patients who would be at high risk with the standard open repair. These high-risk patients may be prone to wound complications for a variety of reasons, including diabetes, skin colonization secondary to existing colostomy, steroid-dependent chronic obstructive pulmonary disease (COPD), extensive atherosclerosis, poor renal function, and obesity. The risks presented by these characteristics are unavoidable if these patients are to be treated with interventional devices that require open femoral artery access. However, to minimize the influence of these risks, other contributory factors may be susceptible to change.

The 2 main factors implicated as major contributors to wound infection are processes that decrease tissue oxygenation and processes that interfere with immune system efficiency. Hypothermia, anxiety, vasoconstriction resulting from pain, and smoking all affect tissue oxygenation. Chronic steroid use and malignancy have been linked to hampered immune system function [Schwartz 1988, Kurz 1996]. Both contributing factors are negatively affected by advanced age, obesity, diabetes, COPD, renal insufficiency, and redo procedures. Although few of these variables can be modified at the time of surgery, some are amenable to optimization. Some high-risk patients benefit significantly from antibiotic prophylaxis prolonged to 48 hours postoperatively [Wengrovitz 1990]. Kurz and coworkers [1996] demonstrated that avoidance of hypothermia reduced the wound infection rate from 19% to 6%.

Lessons learned from extremity arterial bypass studies have contributed to improved outcomes of endovascular inci-

sions. Wound complications may occur in up to 50% of patients undergoing lower extremity revascularization procedures, and the groin incision significantly contributes to this morbidity [Wengrovitz 1990]. One hundred twenty-six in situ infrainguinal revascularizations were reviewed by Reifsnnyder et al [1992]. Those investigators reported a total of 55 wound complications in 117 patients (a complication rate of 44%). Twenty (16%) of the cases of complications involved the groin. Schwartz et al [1988] reported their experience with in situ infrainguinal bypass. In 98 procedures, 31 (31%) of the patients developed wound complications, 4 (4%) of the cases localizing to the groin. Wound hematoma and lymphatic leak were significantly associated with subsequent wound infections. Aggressive treatment (or avoidance) of each complication has been shown to reduce the wound infection rate from 57% to 10% [Schwartz 1995].

Of the numerous risk factors for wound complications proposed in the vascular surgical literature, univariate and multivariate analyses of these possible risk factors in our patient population did not show any one characteristic to be significantly associated with wound complications. This outcome was certainly a function of the small size of our series and the small number of events (complications) that could be used for such analyses. For this reason it is difficult to assess, on the basis of the results of this study and findings in the literature, the relative importance of each of these characteristics in predisposing high-risk patients to wound complications after endovascular aneurysm surgery.

The surgical technique and type of incision can affect the success of wound healing. Excessive retraction on the wound margins, body habitus-induced stress on the wound axis, maceration of a longitudinal wound beneath a heavy pannus, and transection of tissues crossed by lymphatic channels all contribute to negative outcome. Vertical or oblique incisions can be used for femoral arterial access. Previous studies have shown complication rates of 7% to 18% for vertical incisions [May 1995, Moore 1996, Walker 1998] and 0% to 2.8% for oblique incisions [Chester 1992, Raza 1999]. Kent et al [1996] prospectively identified the wound complications for patients who had groin incisions as their only infrainguinal incision. Seventy-seven groin incisions were made in 50 patients. The procedures included aortobifemoral bypass (17 patients), axillobifemoral bypass (10 patients), common femoral endarterectomy (8 patients), femoral embolectomy (5 patients), arteriovenous fistula repair (3 patients), and other (2 patients). Wound complications excluding hematoma occurred in 6 (8%) of 77 incisions, the complications being 4 cases of seroma, 1 case of infection, and 1 case of wound dehiscence. Chester and associates [1992] performed a randomized study comparing the wound complications of vertical versus oblique incisions in the groin during vascular reconstruction, infrainguinal revascularization procedures constituting a majority (83%) of the operations. In that group of patients, 5 (6%) of 85 vertical wounds developed infection with purulent discharge, whereas none of the 82 oblique incisions became infected ($P = .032$). Chuter et al [1998, 2000] reported a decrease in wound infections from 5 of the first 58 to 0 of the last 58 patients in a study in which they evaluated a switch from vertical to oblique incisions in

high-risk patients. Hamman and coworkers [1983] described a series of 42 aortobifemoral bypasses in which oblique incisions were used to access the femoral vessels. In all cases the exposure was adequate, and there was only 1 case of lymphorrhea (complication rate, 2%) and no case of wound infection. A recent report by Caiati et al [2003] in which the subjects were 98 patients who received oblique groin incisions demonstrated development of lymphatic or infectious complications in only 5 of 176 femoral incisions. As a result of the favorable outcome in their study, Caiati et al championed this incision as the optimal approach for femoral arterial access.

The lower morbidity after oblique groin incisions may be due to a number of factors. The incision is routinely made 2 fingerbreadths superior to the groin crease, thereby avoiding the moist region subject to mechanical disruption, distortion, and potential coverage by excessive pannus. In addition, data suggest that vertical incisions may adversely affect the blood supply to the skin on the medial side of the incision. In a report by Raza et al [1999] on the impact of a vertical groin incision on skin perfusion, a significant difference in oxygenation was found between the skin on the lateral aspect and that on the medial aspect of the incision. It is possible that the oblique incision is less disruptive of the blood supply to the wound, a factor that leads to a decreased rate of infectious wound complications. Our experience further supported the use of this approach to femoral arterial cannulation for interventional procedures.

CONCLUSIONS

Groin wound complications are potentially common in high-risk patients undergoing open femoral artery access for endovascular procedures. These problems lead to further complications, including extended hospital stay, increased cost of care, delayed rehabilitation, graft infection and/or thrombosis, need for subsequent operative procedures, and possible limb loss or death. We found that the oblique groin incision for femoral artery access provides ample exposure for these procedures with decreased postoperative wound morbidity. On the basis of this experience, we suggest that the oblique groin incision for femoral artery access be considered as the preferred technique for endovascular procedures. This approach also may be useful in the care of patients who need femoral access for lower extremity arterial bypass procedures.

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