EXPOSURE OF THE ANTERIOR SPINE: TECHNIQUE AND EXPERIENCE WITH 66 PATIENTS

EVAN B. COHN, JEFFREY M. IGNATOFF,* THOMAS C. KEELER, DAVID E. SHAPIRO AND
MICHAEL D. BLUM

From the Divisions of Urology and Orthopedic Surgery, Department of Surgery, Evanston Northwestern Healthcare, Evanston, and Departments of Urology and Orthopedic Surgery, Northwestern University, Chicago, Illinois

ABSTRACT

Purpose: Anterior spinal fusion has become an increasingly popular technique used by orthopedic surgeons for a variety of lower spine pathology. At our institution urologists have assisted as retroperitoneal surgeons in achieving exposure of the appropriate spinal disk space. We report our experience with anterior spinal fusion in 66 patients.

Materials and Methods: Since 1991 we have performed 66 exposures using the flank, modified Gibson, thoracoabdominal, paramedian and midline transperitoneal approaches. Exposure of each level has subtle technical issues which are reviewed.

Results: During the study 34 men and 32 women 24 to 74 years old (mean age 43.8) underwent discectomy and anterior fusion of the spine. Access from T12 through L5-S1 interspace was required, and exposure of multiple spinal levels was necessary in 27. There was 1 death from massive pulmonary embolism in a patient with widely metastatic lung cancer. Retrograde ejaculation was reported by 2 men. There have been no episodes of deep or superficial wound infection and no ureteral or major vascular injuries.

Conclusions: As surgeons of the retroperitoneum urologists have an important role in providing our orthopedic colleagues with safe, adequate exposure to the anterior surface of the spine during discectomy and anterior fusion.

KEY WORDS: spinal cord diseases, retroperitoneal space, intraoperative complications

Anterior spinal fusion has become an increasingly popular and effective approach for the treatment of a number of processes involving the lumbar spine. Initially described as a treatment for Pott's disease, its use has expanded to a variety of spinal lesions.[1,2] As the incidence of Pott's disease diminished, anterior approaches have been used for children with thoracolumbar scoliosis and adults with spinal instability, abscesses, traumatic injury or malignant degeneration.[3]

Access to the anterior spine requires a major surgical endeavor with significant potential for morbidity and mortality. In an attempt to minimize complications a 2-team approach has been described but not previously in the urology literature.[4] Urologists as retroperitoneal surgeons can aid the orthopedic surgeon in obtaining safe and adequate exposure to the anterior surface of the spine, while identifying and protecting the viscera, great vessels and ureter.

MATERIALS AND METHODS

A total of 66 patients, including 62 selected by a single orthopedic surgeon (D. S.), had indications for discectomy and anterior spinal fusion. For a patient to be included in this study the complete chart for the hospitalization during which the anterior exposure was performed had to be available. The operative dictation from the urologist and orthopedic surgeon was reviewed in each case. The main indications for an anterior approach to the spine were instability or failed posterior fusion followed by abscesses and malignancy.

Patients met with the urologist before surgery to discuss the risks generated from the exposure portion of the procedure. All men were counseled regarding the slight risk of retrograde ejaculation and, when appropriate, were advised

to bank sperm before the procedure, which no patient sought. The need for anterior access and spinal fusion rather than the more traditional posterior spinal fusion was dictated solely by the orthopedic surgeon. The incision used to approach the anterior spine was based on spinal levels required, patient habitus, previous abdominal surgery and surgeon preference. There are technical points relevant to each incision that can help prevent complications.

Bowel preparation consists of 4 l. GoLYTELY for 3 hours midday 1 day before surgery, followed by clear liquids and nothing by mouth after midnight. A single dose of a cephalosporin antibiotic is administered 1 hour before incision. Informed consent is obtained. The patient is anesthetized with general oral endotracheal anesthesia after placement of compression stockings and sequential compression boots. A Foley catheter and nasogastric tube are placed. If a posterior procedure is to be performed first the nasogastric tube should be placed at the beginning of the procedure as facial swelling from being prone can make later insertion difficult. The patient is positioned supine on the operating table for exposure of the L3-4, L4-5 and L5-S1 interspaces or in a modified flank position for L2-3 exposure or higher. The table is slightly extended to evert the abdomen and is tilted to the contralateral side to facilitate exposure.

A variety of incisions have been used, including midline transperitoneal, extended Gibson extraperitoneal, thoracoabdominal and paramedian extraperitoneal. The transperitoneal approach is usually reserved for repeat procedures when the retroperitoneal approach is precluded by prior surgical scarring. The Gibson approach results in a more cosmetic scar but is best for only the L5-S1 level or the L4-5 level. Our preferred approach has been the left paramedian, which allows easy access to the lumbosacral spine from L2-S1.

The skin and subcutaneous tissues are penetrated down to

anterior rectus fascia, which is incised lateral to the midline along the lines of the skin incision. Kocher clamps are used to elevate the anterior rectus fascia, and the rectus muscle is retracted and dissected medially. Lateral vessels to the rectus are tied with 2-zero silk suture and cut. The posterior rectus sheath and its caudal continuation of transversalis fascia are penetrated bluntly at the caudal end of the exposure, and the plane between the transversalis and peritoneum is developed bluntly. We have found it advantageous to leave the posterior rectus sheath intact during the early part of the dissection to provide a uniform counter tension on the transversalis fascia during finger dissection of the peritoneum from its underside and around the posterior abdominal wall to the iliac vessels.

In the male patient the processus vaginalis is freed from the spermatic vessels, tied and cut. In the female the round ligament is similarly tied, cut and used for retraction. After completing the majority of this dissection through the inferior "window" through the otherwise intact posterior sheath, the sheath is incised to the cephalad extent of the incision. The cephalad posterior rectus sheath must be incised further cephalad than expected, as this will be the limiting aspect of the subsequent exposure.

The key to the remainder of the exposure is the judicious use of a table mounted, self-retaining retractor. A small Mayo blade is used to retract the left abdominal wall toward the iliac crest. A wide Deaver blade is well padded and used to retract the peritoneum medially. The ureter is clearly identified and protected by this retractor. We use 1 or 2 narrow retractors at the cephalad aspect of the field.

Dissection proceeds up to and over the left external and common iliac arteries and aorta. The left common iliac vein is exposed, and several lumbar veins must be tied with 2-zero silk suture and cut to allow adequate mobilization of the vessel. Failure to secure these lumbar veins often results in troublesome bleeding if they are torn by the spine surgeons during that portion of the procedure. Care is also taken to avoid compression of the iliac vein or vena cava. The L5-S1 interspace is usually accessed just below the bifurcation of the aorta. The L4-5 interspace is approached just lateral to the takeoff of the left common iliac artery and the more cephalad levels are approached lateral to the aorta. Lumbar arteries and veins are tied and cut, and the great vessels are mobilized off the anterior spinous ligament to provide access for the spine surgeon. Attempt is made to preserve sympathetic nerve trunks but some nerve twigs are invariably sacrificed.

The blades of the self-retaining retractor are readjusted as many times as necessary to provide adequate exposure. If possible, the blades of the narrow retractor are positioned to protect the great vessels from the orthopedist saws, rongeurs and so forth. Each spinal interspace was marked with a spinal needle (see figure) and intraoperative cross-table radiographs were performed so the orthopedic surgeon could verify that the appropriate levels had been marked and that there was adequate exposure to perform the procedure.

At this point the orthopedic surgeon joins the case to open the disk interspace, remove the disk material or tumor and place the bone graft blocks. Some orthopedic surgeons use a bone graft harvested from the ipsilateral anterior iliac crest, and require the lateral Mayo blade of the self-retainer to be removed for exposure. If a Gibson incision has been used, the iliac crest may be approached through the incision. However, if the paramedian approach is used, a separate incision is usually necessary to harvest the bone graft.

Closure is rapidly accomplished with figure of 8 sutures of 1-zero polyglactin in the posterior sheath and running 1-zero polyglactin in the anterior sheath. Subcutaneous tissue is irrigated and the skin is closed with clips. Nasogastric suction is maintained for 48 to 72 hours. Diet is advanced slowly as ileus is common and exacerbated by the large postopera-
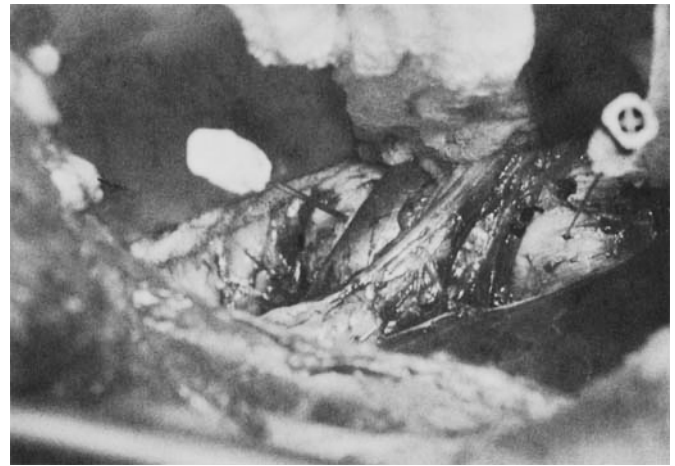
Intraoperative view of anterior exposure of L4-5 and L5-S1 disks. View from right side of patient with cephalad on left. Spinal needle is inserted in each disk.

tive narcotic requirements. Mobilization of the patient is dictated by the orthopedic surgeon.

RESULTS

A total of 34 men and 32 women underwent anterior spinal fusion and discectomy in 6 years. Average patient age was 43.8 years (range 24 to 77) at the time of initial surgery. Access was required from the T12-L1 interspace to the L5-S1 interspace, and multiple level access was required in 27 cases, with 1 requiring access to L1-4. Average length of hospitalization for the procedure was 7.3 days (range 4 to 33). All patients had nasogastric tubes placed intraoperatively, which were managed at the discretion of the urology service and were left in place for an average 2.3 days until the patient had spontaneous flatus. Incisions were tailored to the level of access required, and most cases involved access to the L3-L4 through the L5-S1 interspace (see table).

Complications reviewed are specific to the actual exposure portion of the procedure and exclude the orthopedic aspects of the surgery. There was 1 death in the series, which occurred 9 days postoperatively in a patient with widely metastatic lung cancer. The fusion was attempted to palliate

Surgical approach to each spinal level listed by type of incision

Spinal Level/Incision	No. Performed
T12–L1/thoracoabdominal	2
L1–L2:	
Thoracoabdominal	2
12th Rib	1
L2–L3:	
11th Rib	2
12th Rib	1
Subcostal	1
Midline	1
L3–L4:	
11th Rib	2
Subcostal	1
Gibson	4
Paramedian	4
Midline	2
L4–L5:	
11th Rib	2
Subcostal	2
Gibson	14
Paramedian	16
Midline	3
Phannenstiel	1
L5–S1:	
Gibson	11
Paramedian	17
Midline	3

metastatic disease, which had made the spine unstable. The cause of death was multisystem organ failure and liver metastasis, and occurred after a do not resuscitate order. Reexploration for pain and abdominal mass was required in 1 patient. The initial postoperative course was unremarkable and the patient was discharged home on postoperative day 5. He presented to the emergency room the next morning with a large retroperitoneal fluid collection. At exploration a large collection of straw colored fluid consistent with serum was drained. No source of bleeding or lymphatic leakage was found. The patient did well and was discharged home on postoperative day 3. Retrograde ejaculation was reported postoperatively by 2 of 34 (6%) men. Neither patient opted for preoperative sperm donation or had any interest in future fertility. Replacement of a nasogastric tube secondary to ileus was required in 2 cases. Additionally, there was 1 deep venous thrombosis that required anticoagulation, and 1 episode of Clostridium difficile colitis. There were no ureteral injuries, superficial wound infections, refractory episodes of urinary retention requiring chronic or intermittent catheterization, or major vascular injuries.

DISCUSSION

We provided access to the anterior spine of 66 patients. We avoided injuries to the great vessels and ureters, which have been previously reported,[5-7] in large part due to careful exposure of the great vessels and protecting them behind a carefully padded, self-retaining retractor. The reported ureteral injuries all occurred when the ureter had not been specifically identified, which we believe should be done in every case. The single postoperative mortality was at least in part due to an intercurrent disease process and a large series has reported the mortality associated with anterior spinal fusion to be 0.3%.[8] Retrograde ejaculation was reported postoperatively by 2 of 34 men, which is a somewhat higher rate than in other reported series. However, in these other series data were abstracted from office charts of orthopedic surgeons.[9] This method may not be as accurate as either a blinded or third party survey, or that conducted by a urologist. Even if the incidence is low, informed consent regarding the risk of retrograde ejaculation must be obtained, particularly when this procedure is performed in the pediatric or adolescent age group.

Problems with urinary retention and postoperative urinary tract infection have been reported.[8, 10] A documented urinary tract infection occurred in 1 patient (1.5%), which responded to oral antimicrobial therapy. Adherence to sterile technique during insertion of a system composed of a closed drainage bag along with attempts to remove the catheter as soon as feasible helps to minimize the risk of infection. No patient in our series had an episode of urinary retention that required chronic or intermittent catheterization. Average patient age was 43.8 years. When working with an older population, particularly older men, urinary retention may become more of an issue, which furthers the need for urological involvement. Mobilization as soon as permitted by the orthopedic surgeon will aid the return of normal urinary function. The literature concerning anterior spinal exposure details a number of other complications that are possible secondary to the procedure, including retroperitoneal fibrosis,[11] impotence,[9] rectus sheath hematoma,[12] psoas abscess,[13] pseudomeningocele,[14] pancreatitis,[15] latissimus dorsi rupture[16] and femoral nerve palsy.[17]

A number of recent reports have detailed a minimally invasive and laparoscopic approach to anterior spinal fusion.[18-21] The laparoscopic equipment is typically available at most institutions and urologists should strive to maintain expertise in providing this type of access should spine surgeons believe that it provides an adequate orthopedic result. A potential added benefit to urological participation in expo-

sure of the anterior spine is that with the evolving minimally invasive techniques of stone management there is less retroperitoneal surgery. Resident exposure and education are markedly enhanced by participation in cases of this type.

CONCLUSIONS

Urological participation in exposure of the anterior lumbar spine offers benefits to the patient, orthopedic surgeon and urologist. Major complications of retroperitoneal surgery, and injury to the great vessels and ureters have been avoided in our series. The orthopedic surgeons have been satisfied with the quality of exposure and the speed with which it has been accomplished. In addition, with diminishing retroperitoneal surgery this procedure offers valuable operative experience in urological training programs.

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