Inflammatory Iliac Aneurysm With Ureteral Obstruction

MODERATOR: Jerry Goldstone, M.D.
PANELISTS: Jack L. Cronenwett, M.D.
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Moderator: The patient is a 67-year-old white male with a history of increasing urinary frequency and nocturia. He is otherwise in good health, except for a long history of hypertension for which he is taking nifedipine. He has no other significant medical problems. His family doctor ordered a urinalysis that showed microscopic hematuria. A urologist ordered an intravenous urogram that demonstrated obstruction of the right renal collecting system and poor visualization of the kidney. A retrograde pyelogram (Fig. 1) also demonstrated a dilated and displaced right ureter and some calcification in the area of the iliac arteries. Because of these findings, a computed tomography (CT) scan was performed.

Fig. 1 Retrograde pyelogram showing medial deviation of right ureter with mild dilatation (arrow).
(Fig. 2) that showed the dilated and displaced right ureter and bilateral large iliac aneurysms. In addition there was at least some question on the part of the interpreter whether there was evidence of a chronic contained rupture on the right side.

Physical examination revealed no palpable abdominal or rectal masses. All pulses were normal. Laboratory evaluation revealed a white count of 6900, hematocrit of 45%, hemoglobin of 15.6 gm, creatinine of 1.6 mg/dl, and blood urea nitrogen of 24 mg/dl. Liver function studies were normal as was the coagulation panel. Dr. Zarins, what are your thoughts?

**Dr. Zarins:** I am impressed with the size of these iliac aneurysms.

**Moderator:** Do you think it is possible that there has been a contained rupture?

**Dr. Zarins:** A contained rupture is certainly possible with aortic aneurysms. These are real entities that occur rarely. I have seen them with iliac aneurysms and they are usually focal disruptions with an inflammatory component. They usually are quite small. There is an area that shows some thickening on the wall outside the rim of calcification of the iliac aneurysm. This could conceivably be a contained rupture or an inflammatory component. Sometimes with inflammatory aneurysms there is a rim of tissue surrounding the aneurysm and sometimes it is hard to differentiate between a contained rupture and an inflammatory aneurysm.

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**Fig. 2** CT scan showing calcified aneurysm wall of bilateral iliac aneurysms. Note ill-defined soft tissue adjacent to right iliac aneurysm.
Moderator: Does the fact that the ureter is drawn in medially in the presence of these large aneurysms help distinguish one from the other?

Dr. Zarins: The drawing in of the ureter is more consistent with an inflammatory aneurysm with the retraction of the ureter into the inflammatory mass. Usually with large aneurysms the ureters are displaced laterally. If there is medial displacement of the ureter, it should be an inflammatory aneurysm.

Moderator: Dr. Cronenwett, what are your thoughts?

Dr. Cronenwett: It is difficult to be certain from this CT scan exactly where the iliac aneurysm ends. I assume that it ends at the bifurcation of the common iliac artery. However, I cannot be certain that it does not involve the external iliac artery. I agree with Dr. Zarins about its probable inflammatory nature. A contained rupture, although it can be this discrete, is usually contained more by surrounding soft tissue and tends to have a more diffuse look than the discrete enlargement around the outside of this aneurysm.

Moderator: What do you think about the likelihood of a contained rupture with the absence of any abdominal or back pain? Does it make that more or less likely?

Dr. Cronenwett: It makes it less likely. Although we have seen contained rupture of an aortic aneurysm in the absence of symptoms, it is unusual. It would be difficult to explain the compression of the ureter based on a contained rupture. I have not seen that situation.

Dr. Zarins: This concept of contained rupture is interesting. There is some controversy as to the pathogenesis of aneurysms. Is atherosclerosis an important feature? I think it is. Small aneurysms sometimes begin with focal plaque degeneration. It is somewhat akin to an ulceration elsewhere where the plaque becomes thin, the artery wall underneath is thinned, and there is a focal bulging or a sacular aneurysm. Sometimes this can be interpreted as a contained rupture as it enlarges. Whether it is a contained rupture or a localized degeneration and a sacular aneurysm with an inflammatory reaction is not always clear. If this process happens focally, there may be a defect in the wall that is actually a developing sacular aneurysm as opposed to a diffuse process around the whole circumference with diffuse enlargement referred to as a fusiform aneurysm. We have seen such specimens in the iliac arteries and in the aorta with a small erosion, like an ulceration in a plaque, and what we call a contained rupture on angiography sometimes is really an excavation of a plaque. Is this a contained rupture or an ulceration of a plaque or a sacular aneurysm?

Moderator: We have these findings on the X-ray studies. Are there any other diagnostic studies that either of you would consider important before making a therapeutic recommendation?

Dr. Cronenwett, you mentioned that you could not locate the end of these aneurysms. How can this determination be made?

Dr. Cronenwett: I would obtain an arteriogram in this patient to better define the external iliac artery because the point for the distal end of the
reconstruction in this case is not clear from the CT scan. In addition the patient has a long-standing history of hypertension and borderline renal insufficiency. There is probably not substantial renal artery disease that will bear on this case, but I would obtain the arteriogram to further evaluate the renal and pelvic arteries.

Moderator: Does the fact that the patient has an elevated serum creatinine level influence your decision?

Dr. Cronenwett: That factor would influence how the patient is managed at the time of the arteriogram in terms of hydration and it would limit the amount of radiographic contrast that we would use. However, it is important in this case to obtain the information provided by the arteriogram.

Dr. Zarins: It is also important to evaluate the visceral vessels. The CT scan shows that in addition to the common iliac aneurysm, there is also an internal iliac artery aneurysm. In considering repair it is possible that both internal iliac arteries will have to be ligated, which will potentially impair pelvic perfusion. It is important to know the status of the celiac and superior mesenteric arteries and whether the inferior mesenteric artery should be revascularized as this aneurysm is repaired.

Moderator: Do the angiographic studies (Figs. 3 and 4) provide any answers?

Dr. Cronenwett: As I suspected, the renal arteries are not involved. There may be slight stenosis of the right renal artery, but this is a trivial problem in this patient. It also appears that the iliac aneurysm probably does not involve the external iliac artery. I suspect that this reconstruction could be accomplished either to the very end of the common iliac artery or to the external iliac artery. In addition I agree with Dr. Zarins about the usefulness of obtaining information about mesenteric circulation. If there is a view of the infrarenal aorta to see the inferior mesenteric artery, or the collateral in that area, it would not be necessary to obtain specific views of the superior mesenteric artery and celiac. If the inferior mesenteric artery is large and the collateral pattern suggests disease in the superior mesenteric artery, these views would be important. However, we routinely obtain proximal, cross-table lateral views of the aorta (in biplane fashion) during the proximal aortogram to visualize the celiac and superior mesenteric origins.

Dr. Zarins: These aortograms are not particularly helpful because the things that interest me are not visible. I do not see the celiac or superior mesenteric artery. An internal iliac aneurysm cannot be diagnosed from this arteriogram. What can be seen is that both internal iliac arteries are patent. However, there certainly could be an aneurysm of one or both. I suspect there is a right internal iliac artery aneurysm. However, that would be seen at operation. The best way to look at it is on the CT scan. A normal-caliber lumen does not rule out the possibility of an internal iliac artery aneurysm.
Fig. 3  Mid-stream aortogram demonstrating mild stenosis of both renal arteries.

Fig. 4  Pelvic portion of aortogram showing bilateral common iliac aneurysms significantly smaller than suggested by CT scan, normal-appearing external iliac arteries, and patent internal iliac arteries.
**Moderator:** With this amount of diagnostic information, let’s turn our attention to the treatment. First, how would you recommend approaching these aneurysms surgically? Is a retroperitoneal approach useful in situations like these?

**Dr. Cronenwett:** I would not approach these retroperitoneally. Because of the large iliac aneurysms, specifically on the right side, I would approach them through a transperitoneal incision. I would prefer to use a transverse infraumbilical “smile” incision in this patient, which I think affords optimal exposure of the pelvis. The infraumbilical transverse incision provides the best access for dealing with the internal iliac arteries and still allows good exposure to the infrarenal aorta. However, before surgery, we should at least contemplate the right ureter and the right kidney. The films show a hydronephrosis. My inclination and my urologist’s recommendation would probably be to stent the right ureter preoperatively and decompress the kidney several days before the procedure.

**Moderator:** Do you think stenting the ureter aids the surgical dissection?

**Dr. Zarins:** It may in terms of being able to identify that ureter. There are times, particularly if the aneurysm is inflammatory, when it may be very difficult to identify that ureter. A stent will aid that situation.

I would like to comment about the incision. I would use a transperitoneal approach, primarily because of the right internal iliac artery aneurysm. However, I would go midline because of the possibility of having to ligate both internal iliac arteries. I would like to maintain flow into at least one of the internal iliac arteries if at all possible. However, occasionally this is not possible and this may be one of those occasions. A transverse incision cuts across the inferior epigastric arteries and would interrupt collateral blood flow coming from the chest wall. Preservation of collateral blood flow coming down through those channels is important to maintain pelvic perfusion if the internal iliac arteries are occluded.

**Dr. Cronenwett:** I am not aware of problems with pelvic collaterals after a transverse incision in these cases, presumably because the external iliac and femoral arteries are revascularized, which provides direct flow to the circumflex collaterals. This makes the divided inferior epigastric collateral less important.

**Moderator:** What about ureteral protection and ureteral stenting? Is that always recommended in this situation?

**Dr. Zarins:** I personally use ureteral stents very rarely and never to palpate or find the ureter at operation. If there is a big inflammatory mass, I stay away from the region where the ureter may lie. If necessary, I clamp at the diaphragm and work from within the aneurysm. I am not sure whether ureteral stenting really prevents ureteral injury. This is often suggested. We do not happen to do it.

**Dr. Cronenwett:** It may not only be important in terms of preventing ureteral injury, but depending on the degree of hydronephrosis and the degree that that is impacting on kidney function, it may be therapeutic. To what extent you are able to, or even want to, free that ureter from the inflammatory mass is debatable, but
having the stent in place and possibly even leaving it in place for up to several months, depending on the subsequent retrograde studies, may be therapeutic in terms of kidney function. I was thinking of this, in addition to identifying the ureter, in my recommendation to place a stent.

**Dr. Zarins:** If there is hydronephrosis, the ureteral catheter will decompress the kidney. That is very important and very useful. In this particular case there is not significant hydronephrosis, at least from the films I have seen, so I would not use one.

**Moderator:** The consulting urologist in this case did not feel that catheterizing the ureter was important in terms of drainage of the kidney. However, I think it is an important consideration, particularly if there is concern about proximal infection above an obstructed ureter.

This patient was operated on through a midline incision and while exploring the abdomen, a subrenal aorta of normal caliber was identified, although it was circumferentially atherosclerotic. The aortic bifurcation was deviated to the patient's right where a large fusiform right common iliac aneurysm was easily seen, measuring approximately 5 cm in diameter. The common iliac and its bifurcation were surrounded by a dense periarterial inflammatory reaction that completely encased the crossing ureter. This inflammatory tissue was white, firm, moderately well vascularized, and had the typical appearance of an inflammatory aneurysm. It did not involve the abdominal aorta, however, or the left iliac vessels. The left common iliac artery was likewise diffusely involved with a fusiform aneurysm measuring 4 cm in diameter. Both internal iliac arteries were aneurysmal. The aneurysm on the left measured approximately 4 cm in greatest diameter and had a short neck right at the bifurcation of the common iliac artery. Both internal iliac aneurysms were lengthy and appeared to extend several centimeters into the pelvis. The external iliac arteries measured approximately 1 cm in diameter and, although slightly thickened, were soft with excellent pulses. The inferior mesenteric artery was patent.

**Dr. Zarins:** I would plan on performing an aorto-external iliac bypass bilaterally, with ligation of both internal iliac arteries and reimplantation of the inferior mesenteric artery. It is important to try to stay away from the inflammatory mass as much as possible, particularly where the ureter is crossing, so that the ureter is not injured. Once the aneurysms are repaired, the inflammatory mass will probably subside and ureteral involvement will diminish, which is what usually happens with inflammatory aneurysms. Technically, it is a challenge. I would try to do a standard end-to-end anastomosis to the infrarenal aorta and obtain control of the external iliac artery, probably just above the inguinal ligament, in an area that I presume is not inflamed from your description. I would pass the graft limb through the aneurysm after it is opened so that it is tunneled underneath the ureter without actually dissecting that area. The biggest challenge is in handling the internal iliac arteries, which, if they are as large and extensive as you have described, extend way down into the pelvis. If
there is a great deal of inflammation around these aneurysms, any effort to get
down around the aneurysm will be a problem, causing bleeding from the pelvic
veins. These internal iliac artery aneurysms would have to be suture ligated from
within the aneurysm sac rather than actually obtaining control distally and
ligating the branches in the pelvis.

Moderator: Dr. Cronenwett, do you think the entire infrarenal aorta must be
replaced? What about putting the graft below the inferior mesenteric artery and
preserving flow in that fashion?

Dr. Cronenwett: That may be a tempting idea because of the additional
problem of having to reimplant the inferior mesenteric artery. However, I would
replace the entire infrarenal aorta simply because of the theoretical possibility
that the remainder of the aorta will become aneurysmal. That may be somewhat
theoretical in a 67-year-old man and that judgment would have to be made in the
operating room. However, my tendency would be to do as Dr. Zarins suggested
and replace the infrarenal aorta in a standard fashion and reimplant the inferior
mesenteric artery if it appeared, as it does from your description, that both the
internal iliacs would have to be ligated.

Moderator: Would you mobilize the ureter? There is some evidence of hy-
dronephrosis and it is densely encased in the periarterial fibrous tissue. Are you
worried that the operative manipulation is going to lead to obstruction of the
ureter?

Dr. Cronenwett: I would already have my ureteral stent in place so I am
not worried. However, I agree that I would not dissect the inflammatory mass
around the ureter and would not perform a ureterolysis. In my limited ex-
perience that can be difficult and often leads to injury of the ureter. The
likelihood that the inflammation will recede and that the ureter will be
freed over time is high. I would not do anything with the ureter except stay away
from it.

Dr. Zarins: I agree. I would not manipulate it. I would get control of the
vessel above and below the inflammatory mass and pass the graft through the
lumen of the aneurysm, which in essence is going underneath the ureter, and not
dissect the inflammatory mass.

Moderator: In this patient it was possible to dissect the left common iliac
bifurcation. As I indicated there was a neck on the internal iliac aneurysm,
though it was short, measuring approximately 2 cm in diameter. How would
you obtain control of the right internal iliac artery?

Dr. Cronenwett: The area involved in the inflammatory mass should proba-
ably not be dissected. Necessary additional arterial control will be obtained after
the external iliac artery on that side is opened. There may be back-bleeding from
the internal iliac artery when the aneurysm is opened that can hopefully be
controlled with a balloon from inside that vessel. It may be more difficult if the
origin of the internal iliac artery is in the middle of the inflammatory mass in
which you are trying to avoid dissection. I agree with Dr. Zarins that tunneling
the graft through the arterial orifice on the right side to avoid a longitudinal
incision across the area of the ureter is a good idea. This may, however, lead to some difficulty exposing the internal iliac. If that is the case, an incision should be made in that area, from the medial side of the pelvis to try to avoid the ureter, to gain control of that internal iliac orifice. It is difficult to envision that unless you are looking at it.

**Dr. Zarins:** Dr. Cronenwett is correct. It is important to work from within the aneurysm. Usually with noninflammatory aneurysms, you can dissect around an internal iliac artery aneurysm very readily and ligate each branch outside the aneurysm. With an inflammatory mass, it is better to work from within the aneurysm and suture ligate it. If you cannot technically suture the distal internal iliac artery, you could consider putting in permanent balloon occlusion catheters. However, I have never found that to be necessary.

**Dr. Cronenwett:** In terms of the left side of the pelvis, it is very useful to approach iliac aneurysms laterally by taking down the lateral attachments of the sigmoid colon and approaching the iliac bifurcation from the lateral side of the sigmoid rather than trying to retract all the intervening retroperitoneal structures from the medial side. It affords excellent exposure and makes the approach as facile as on the right side without the sigmoid colon present.

**Moderator:** We essentially followed your suggestions in this patient. The aorta was replaced beginning from just below the renal arteries. The right internal iliac artery was temporarily controlled with an intraluminal balloon. As you suggested, we used an end-to-end anastomosis to the external iliac artery on the right. The right internal iliac aneurysm was opened and oversewn from within. We used the same procedure on the left, only there were two large vessels at the base of the internal iliac aneurysm. Both were vigorously back-bleeding and they were individually oversewn so it was not possible to maintain antegrade perfusion in either internal iliac artery. An end-to-end anastomosis was done to both external iliac arteries. The next problem was deciding what to do with the pelvic circulation. How would you determine flow in the inferior mesenteric artery? Should the inferior mesenteric artery be reimplanted routinely, as in this case? Should we measure the inferior mesenteric artery back pressure or listen with a Doppler?

**Dr. Zarins:** All those things are interesting and can be done. However, regardless of the results, the inferior mesenteric artery must be reimplanted. The inferior mesenteric artery is a very important source of collateral blood flow to the pelvis when the internal iliacs are ligated. This can be seen arteriographically in patients who have aortic occlusion or external and internal iliac occlusions in which case the inferior mesenteric artery provides flow to the pelvis. It may be a major source of blood flow to both legs through collaterals. In this instance, where widely patent internal iliac artery aneurysms are demonstrated on the operative arteriogram and both have been ligated, regardless of what any of the studies show in terms of back pressure or the inferior mesenteric artery flow, the surgeon is obligated to reimplant that inferior mesenteric artery if it is of reasonable size.
Dr. Cronenwett: I agree with Dr. Zarins. I would reimplant this artery, although it is fair to say that if the inferior mesenteric artery is ligated at its most proximal origin, there is probably adequate collateral circulation coming from the superior mesenteric artery collateral branches in most patients. If that were not the case, we would more frequently have problems with the pelvic vascular supply. It is very difficult to measure back pressure in the inferior mesenteric artery and to have accurate measurements. It is relatively easy to visually assess its back-bleeding, and it is worth noting that back-bleeding from the internal iliac arteries can also be visually assessed by temporarily removing the distal clamp after opening the iliac aneurysm. That gives a reasonable qualitative sense of the adequacy of collateral flow. However, as Dr. Zarins mentioned, in the patient with completely normal internal iliac arteries that must be ligated, and a completely normal inferior mesenteric artery, I would reimplant the inferior mesenteric artery because of the small number of unpredictable cases in which pelvic ischemia develops and is catastrophic. The additional surgery required to reimplant the inferior mesenteric artery is rather trivial in a case of this magnitude.

Dr. Zarins: Did this patient have penile blood pressure measured preoperatively and postoperatively?

Moderator: No.

Dr. Zarins: That measurement may help assess pelvic perfusion through the internal iliac artery aneurysms. It is interesting that the collaterals can go through a number of pathways. We have mentioned the inferior mesenteric artery, but the profunda femoris artery is also an important pathway of collaterals to the pelvis. I remember one case that was similar to this but without the inflammatory component. In the repair of the extensive aortoiliac aneurysm with bilateral internal iliac artery aneurysms, we ligated both internal iliac artery aneurysms and did an aortofemoral bypass. The patient had erectile impotence preoperatively, but none postoperatively. Preoperatively he had patent internal iliac arteries and postoperatively he had an aortofemoral bypass with perfusion of the pelvis through retrograde flow from the profunda. Although you cannot necessarily rely on the profunda to perfuse the pelvis, it is a potential important collateral. Significant pelvic ischemia is a real risk with internal iliac artery occlusion and can occur with normal postoperative pedal pulses if the whole pelvis is bypassed.

Moderator: In this situation I can assure you there was horrific back-bleeding from both internal iliac arteries and after both of those iliac aneurysms were ligated, there was brisk pulsatile back-bleeding from the inferior mesenteric artery. Do you still think it is important to reimplant the inferior mesenteric artery?

Dr. Zarins: Yes.

Dr. Cronenwett: You are describing a situation that probably would not result in pelvic ischemia if the inferior mesenteric artery were not reimplanted. However, for the reasons I just enumerated, I would still reimplant it.
**Dr. Zarins:** Vigorous back-bleeding is not a good predictive measure and, as Dr. Cronenwett mentioned, the consequences of being incorrect in the assessment and having an ischemic pelvis and an infarcted colon are just too great.

**Moderator:** Despite those warnings, the inferior mesenteric artery was not reimplanted but was ligated. The patient was closed and he suffered no consequences. The only remaining question is, what do we do now about the ureter? Dr. Cronenwett would have put in a ureteral stent. However, that was not done in this patient. Would you administer steroids?

**Dr. Zarins:** I do not think so. The inflammatory reaction, now that the aneurysm has been repaired and the aneurysm has been bypassed, will subside and the ureteral reaction can be expected to resolve spontaneously. I do not know of any evidence that steroids reduce the inflammatory component of an inflammatory aneurysm and there is an increased risk of potential poor wound healing, infection, and all the other results that come with steroids.

**Dr. Cronenwett:** Baskerville et al.\(^1\) reported on a few patients who were initially explored because of inflammatory aortic aneurysms and then, because the operative approach was too hazardous, they closed the patients, treated them with prednisone, and followed them with serial CT scans. They were able to follow a decrease in the thickness of the inflammatory component of these aneurysms. This would worry me, however, because as the inflammatory component decreased in size, I would be concerned about possible rupture. If these patients are given steroids, the inflammation will decrease and their pain will be eliminated. However, in most cases this would be contemplated only as a preoperative measure. Postoperatively, I agree with Dr. Zarins that in most surgeons’ experience the inflammation recedes, the ureter subsequently "lyses itself," and that is no longer an issue. I would not treat this patient with steroids.

**Dr. Zarins:** Inflammatory aneurysms are thought to rarely rupture because they have that big thick wall. However, patients may have a great deal of pain for a prolonged period of time. If you treat the patients with steroids and eliminate the pain and inflammatory reaction, does it make it more likely that the aneurysm will rupture?

**Dr. Cronenwett:** I do not think anyone knows the answer to that, although in point of fact, inflammatory aneurysms can rupture and usually do rupture, as most aneurysms do, posteriorly or posterolaterally and not through the anterior wall where the aneurysm is thickened. Steroids really do not impact on the question of whether these can rupture. I think they can and I would be concerned about it.

**Moderator:** There is no doubt the inflammatory reaction can be treated with corticosteroids. However, I have the same reservations you have expressed. The collagenolytic effect of the steroids in the presence of a large aneurysm is frightening and in fact, in some of the published reports, the aneurysms that have been treated with steroids have ruptured. I have been tempted on a few
occasions to treat the patient for at least a short period of time with steroids to try to reduce the inflammatory reaction, but I have not actually done it. Within a month of the operation, this patient’s hydrenephrosis had diminished, the urinary symptoms were gone, renal function had improved, and he was doing well. Do you have any final comments?

**Dr. Zarins:** This is a very interesting case and very instructive on many levels, including the treatment of the ureter, the inflammatory component, and the basic principle of bypassing the aneurysm and not excising it as was the practice in the “olden days.” What we do not understand is, why is there an inflammatory aneurysm and why does that inflammatory aneurysm resolve with diversion of the blood stream? In this instance you did not remove the aneurysm, you did nothing to the aneurysm; you simply prevented it from being in contact with the blood stream and that resulted in resolution of the inflammation. Some physicians think that the inflammation is a reaction to the atherosclerotic plaque, but the atherosclerotic plaque is still there. How this relates to the pathogenesis and the mechanism remains a mystery.

**Dr. Cronenwett:** First, this is an unusual case because of the relatively isolated iliac aneurysms with one involved by an inflammatory reaction. Second, vascular surgery in the pelvis with large iliac aneurysms can be technically very challenging. Success in these cases requires experience in the pelvis. There are many “snakes” in that area that must be avoided. To have done this well in this patient was quite an accomplishment.

**Moderator:** To emphasize, there was a 3500 ml blood loss associated with this operation, so as you suggested, although it sounded in the description as if it was a rather simple process to get control of these iliac aneurysms, including the hypogastrics, there was in fact considerable difficulty and as I indicated considerable blood loss.

**Dr. Cronenwett:** In the future I wonder how to handle this problem of blood loss. There are now radiologic techniques of balloon placement that can be used preoperatively to temporarily control arteries that are difficult to control intraoperatively. When you know that you are going to have a situation deep in the pelvis where you will need to control the internal iliac artery, should we consider preoperative placement of balloons under x-ray guidance for vascular control that might reduce blood loss?

**Moderator:** That would be an excellent subject for another discussion like this. I would like to thank both of you for your comments and participation.

**REFERENCE**