

VASCULAR COMPLICATIONS AFTER TOTAL HIP ARTHROPLASTY

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Four cases of vascular complications in connection with total hip replacement are reported and another 25 cases from the literature summarized. Acute intraoperative injuries most often give rise to severe haemorrhage. Delayed injuries with pseudoaneurysm formation or thrombosis give rise to hip pain, distal ischaemia or haemorrhage when a prosthesis is extracted. There is a dominance of female patients and left-sided operations and cases complicated with infections and reoperations. Aetiologic and therapeutic considerations are discussed.

Key words: arthroplasty; hip; vascular complication

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There is an increasing incidence of total hip replacement and the procedures nowadays are fairly well standardized and safe. Vascular complications are extremely rare and not even mentioned in the current textbooks by Eftekhar (1978) and Charnley (1979). There are, however, some case reports presented in the literature.

As the consequences of vascular complications are potentially dangerous for the patients and also difficult to handle, we found it to be of interest to report on four cases treated in our hospital and to review the literature.

Case 1

A 49-year-old female with severe rheumatoid arthritis and several previous joint operations. In 1975 her right hip was operated on with a Charnley total hip arthroplasty, which, in 1975 was changed to a Lubinus prosthesis with reinforcement of the acetabulum because of central dislocation of the socket. Sixteen months later she developed arterial insufficiency in her right leg with rest pain and signs of distal microembolization. An aorto-femoral angiography showed that the socket again had migrated centrally and that the external iliac

artery was angulated. Due to acute occlusion she was operated on with a femoro-femoral dacron crossover graft. Four days later it was necessary, because of the peripheral embolization to perform a below-knee amputation in spite of an open graft. A few weeks later the socket was extracted via a retroperitoneal right fossa incision.

Case 2

A 65-year-old female with severe rheumatoid arthritis. In 1975 bilateral hip replacement according to Charnley was performed. Postoperatively there was intermittent drainage from sinuses on both sides, and infection was suspected even though reliable cultures were never obtained. Six years later the right hip became painful and eventually there was some bleeding through the sinus. Radiographs demonstrated a proximal and central migration of the socket. Via a lateral hip incision the stem prosthesis could easily be extracted. However, on attempting to extract the socket and the cement a large arterial haemorrhage started. This could be controlled by external compression. Via a hypogastric retroperitoneal incision the common iliac artery was controlled and the socket extracted. The bleeding source was a pseudoaneurysm which was excluded by proximal and distal ligatures after a reconstruction with a femoro-femoral dacron crossover bypass. The postoperative course was complicated by

Table 1 (a)

	Sex	Age	Diagnosis	Side	Injured vessel	Symptoms
Eriksson et al. (1971)	F	53	RA	right	ext. iliac art.	shock, intraabd. bleeding
Mallory (1972)	F	59	RA	left	common iliac vein	bleeding
Breitenfelder & Spranger (1973)	F	70	OA	right	ext. iliac art.	ischaemia after prosthesis removal
Salama (1972)	F	52	OA	left	common fem. art.	bleeding perop. + ischaemia postop.
Dorr (1974)	F	39	RA	right	common fem. art.	pain in hip
Kroese & Møllerud (1975)	F	76	caput necrosis	left	common fem. art.	pulsating tumour
Podlaha & Schultz (1975)	F	57	OA	left	ext. iliac art.	ischaemia
Schöllner & Krasemann (1975)	M	46	OA	right	ext. iliac art.	ischaemia after cup extraction
	F	62	OA	left	ext. iliac art.	ischaemia
Scullin (1975)	F	75	post-radiation necrosis	left	ext. iliac art.	bleeding when evacuating hip haematoma. Rebleeding after 16 days
Hirsch et al. (1976)	F	62	RA	left	ext. iliac art.	ischaemia
Suren et al. (1976)	F	58	OA	left	deep femoral art.	painful, pulsating tumour
	F	75	OA	left	common fem. art. common fem. vein (AV-fistula)	pulsating tumour
Tkaczuk (1976)	F	57	RA	right	ext. iliac art.	bleeding from fistula + pulsating, pulsating tumour

an adhesion ileus, leading to a small bowel resection which was followed by a rather long time with pulmonary insufficiency, making artificial respiration necessary.

Case 3

A 73-year-old male with disabling osteoarthritis. In 1978 the left hip was operated on with a total hip replacement ad modum Lubinus. Postoperatively he developed a thigh haematoma and during the first year an increasing swelling of the left leg. One year postoperatively a large pseudoaneurysm of the left external iliac

artery, caused by large spiculae of bone-cement eroding the artery, was diagnosed. The lesion was reconstructed with a dacron graft passing from the proximal external iliac artery to the common femoral artery. A year later the hip wound became infected and on several occasions it was revised and drained. In the summer of 1981 he developed septicaemia, septic microemboli passing to the left leg and two heavy bleedings from the rectum. The hip prosthesis was extracted and from the hip wound the dacron graft was seen in the abscess. The patient was referred to our hospital and after insertion of a femoro-femoral dacron crossover graft (to the superficial artery below the earlier groin incision) the pre-

Primary (P) or secondary (S) hip operation	Time from injury to op.	Vessel operation	Type of trauma	Final outcome of the vascular procedure
S	6.5 months	dacron bypass	cement erosion	septicaemia and mors
P	immediate	ligature	perforation of acetabulum when reaming	no problems
P	immediate	thrombectomy	intimal flap	no problems
S	immediate	raphia of tear TEA + patch	retractor	no problems
S	9 months	resection + dacrongraft ^a	cement pressure. Pseudoaneurysm	hip disarticulation
S	2 weeks	suture	penetration by the retractor	no problems
P	2 months	thrombectomy + patch graft	cement spicula with pseudoaneurysm	no problems
S	14 days	thrombectomy + patch graft	periarterial fibrosis	forefoot amputation
S	2 hours	thrombectomy	retractor injury?	no problems
S	1-13 years (2 prostheses)	1) raphia 2) ligature + vein crossover	cement erosion. Pseudoaneurysm	no problems
S	a few days	bypass	cement pressure and displacement of artery	no problems
P	2 years	exclusion + dacron graft	cement spicula with pseudoaneurysm	no problems
P	6 months	division of fistula + venoraphy + arterial patch	injury during primary operation	no problems
P	8 months	patch graft	cement spicula with pseudoaneurysm	no problems

vious dacron graft was extracted and the common iliac artery ligated. There was an upper anastomosis pseudoaneurysm and a fistula between this pseudoaneurysm and the sigmoid colon. The bowel emptied directly into the femoral shaft. An irrigation drainage and a transversostomy was performed. The post-operative course was complicated by several septic episodes and a period of jaundice (so far unexplained), but the patient did recover slowly.

Case 4

A 70-year-male with osteoarthritis. In 1971 a right-

sided hip arthroplasty *ad modum* Charnley was performed. One month postoperatively the prosthesis dislocated necessitating an open reduction. After this operation a deep infection developed, treatment with different antibiotics being unsuccessful. In 1974 the prosthesis was extracted through a posterolateral incision. When the acetabular socket was mobilized there was a heavy bleeding from the wound. The patient was turned and through a right hypogastric retroperitoneal incision the socket was extracted and the bleeding localized to a branch of the internal iliac artery. After ligation the haemostasis was adequate. The patient recovered and died a year later of intercurrent disease.

Table 1 (b)

	Sex	Age	Diagnosis	Side	Injured vessel	Symptoms
Nieder et al. (1979)	F	57	OA	left	ext. iliac art.	bleeding at prosthesis removal
	M	63	OA	left	ext. iliac art.	bleeding at prosthesis removal
	M	72	OA	left	ext. iliac art.	bleeding at prosthesis removal
	F	50	osteomyelitis	right	ext. iliac art. ext. iliac vein	bleeding at preparation for socket
	F	73	neck pseudoarthrosis	left	ext. iliac art.	painful swelling. Bleeding at incision
Chrispin & Boghemans (1980)	M	67	OA	left	ext. iliac art.	ischaemia
Aust (1981)	F	66	OA	left	ext. iliac art.	ischaemia
	F	70	OA	left	med. circumfl. fem. art.	pain in hip
	F	69	OA	left	med. circumfl. fem. art.	pain in hip
	M	73	OA	left	common fem. art.	swelling, bleeding
	F	63	OA	left	common fem. art.	ischaemia
Our case 1	F	49	RA	right	ext. iliac art.	ischaemia
Our case 2	F	65	RA	right	ext. iliac art.	bleeding when extirp. the prosthesis because of infection

DISCUSSION

Vascular injuries in connection with total hip replacement are extremely rare and most reports on large series and current textbooks do not even mention it as a theoretical possibility. Table 1 summarizes the hitherto published 25 cases with the addition of our four. Without giving any details, Buchholz et al. (1981) found two cases of iliac pseudoaneurysms among 659 patients with infected arthroplasties, and Boitzky & Zimmermann (1969) and Kehr (1973) three cases of in-

traoperative retractor induced haemorrhage among 983 patients. The female dominance is obvious (22 of 29) also with regard to the 3:2 female/male ratio commonly presented in total hip arthroplasty. Most of the vascular complications have been seen on the left side (20) in spite of the fairly equal distribution of right and left hip reconstructions in large materials. This can probably be attributed to a somewhat more leftward lateral position of the aortic bifurcation and the left iliac artery. All injuries but one were confined to arteries, and in the majority of the cases af-

Primary (P) or secondary (S) hip operation	Time from injury to op.	Vessel operation	Type of trauma	Final outcome of the vascular procedure
S	immediate	end-to-end anastomosis	division of the artery at socket removal	no problems
S	immediate	suture	cement spicula with pseudoaneurysm	new haemorrhage → hip disarticulation
S	immediate	suture	cement spicula eroding the artery	no problems
S	immediate	free vein graft + venoraphy	fibrotic tissue after osteomyelitis and several operations and lateral displacement of vessels	no problems
P	3 years	raphia	cement spicula with pseudoaneurysm	mors on 7th day (pulmonary embolism)
P	immediate	thrombectomy	pressure of the socket	no problems
P	4 days	iliofemoral dacrongraft	pressure of cement. Thrombosis	below knee amputation
P	2 years	ligature	retractor? Pseudoaneurysm	no problems
P	1 month	ligature	pressure of cement. Pseudoaneurysm	no problems
P	immediate	raphia	retractor?	no problems
P	immediate	TEA + patch	retractor? Plaque fract. with thrombosis	no problems
S	16 months	ligature + dacron crossover ^b	central migration of the socket	below knee amputation
P	6 years	ligature + dacron crossover	central migration of the socket	no problems

ected the external iliac artery and the common femoral artery.

Although the vascular complications are rare, several patterns of injury can be seen. Injuries giving immediate symptoms because of perioperative damage are most commonly caused by too violent medial pressure of the retractor, but also by excessive reaming in patients with protusion of the acetabulum. The acute injuries most often give rise to severe haemorrhage.

Injuries causing delayed symptoms are of three types and give rise to symptoms appearing be-

tween a few days and several years after the operation:

- a) pain in the hip caused by pressure of apseudoaneurysm;
- b) ischaemic symptoms in the affected limb due to impaired blood flow or distal microembolization;
- c) severe haemorrhage when extracting a hip prosthesis.

The aetiology is either too large a volume of cement with intrapelvic spiculae causing thermal

Table 1 (c)

	Sex	Age	Diagnosis	Side	Injured vessel	Symptoms
Our case 3	M	73	OA	left	ext. iliac art.	1) pain + pulsating tumour 2) septic emboli + rectal bleeding
Our case 4	M	70	OA	right	int. iliac art.	bleeding when extirp. the prosthesis
a.	graft-thrombosis leading to hip exarticulation.				RA, rheumatoid arthritis.	
b.	below knee amputation.				OA, osteoarthritis.	

damage or erosion of the artery or an intrapelvic dislocation of the socket with pressure and angulation of the artery. There is an overrepresentation of infected and/or reoperated cases among patients with vascular injury. The incidence of vascular complications at our hospital was three in 250 patients with exchange operations and none out of 1850 primary total hip replacements.

Several types of vascular reconstructions have been performed but in one of our cases and in four of the reviewed cases an amputation or disarticulation had to be undertaken. In the third of our cases many of the most dreaded complications of vascular graft surgery are demonstrated: septicaemia, distal septic microembolization, anastomotic pseudoaneurysm and arterioenteric fistula. Two of the 25 published cases died, one of sepsis and one of pulmonary embolism.

There are some important points which can help the surgeon to avoid injuries of this type. A careful operative technique at primary and especially at secondary surgery must be followed, avoiding the use of retractors over the lip over the acetabulum. Also, and especially in cases of acetabular protusion when the major vessels are close to the operating site, care must be taken not to penetrate the bottom of the acetabulum when drilling the holes. Knowledge of the anatomy is important as the intrapelvic vessels pass very close to acetabulum, especially on the left side. As the patients often are elderly the possibility of arteriosclerosis must be remembered as ar-

teriosclerotic vessels are more vulnerable and a periarthritis tends to fixate the vessel.

A distal pulse status before and after hip arthroplasty can help in diagnosing some of the ischaemic complications. Ischaemia of the lower extremity after total hip replacement may also follow peroperative interruption of critical collateral circulation to a limb with circulation already impaired before operation (Matos et al. 1979).

When a socket dislocated into the pelvis is to be extracted the approach of choice is a hypogastric incision with a retroperitoneal dissection. The socket can then easily be removed and there is a possibility of immediate vascular control if needed. In some cases it is also practical to extract the stem prosthesis through the same incision.

When an arterial reconstruction in cases of pseudoaneurysm is needed the use of synthetic graft material must be avoided because of the infection risk with severe secondary complications. In our opinion, the method of choice is exclusion of the pseudoaneurysm after an extraanatomic femoro-femoral crossover bypass.

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Primary (P) or secondary (S) hip operation	Time from injury to op.	Vessel operation	Type of trauma	Final outcome of the vascular procedure
P	1 year	1) dacron bypass	1) pseudoaneurysm because of cement pressure	no problems
	2 years	2) ligature + dacron crossover	2) inf. around the prosthesis and dacron graft	no problems
S	3 years	ligature	lesion when extracting the socket	no problems

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