Intraosseous pO_2 in femoral neck fracture

Restoration of blood flow after aspiration of hemarthrosis in undisplaced fractures

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We recorded intraosseous pO_2 in 9 patients with Garden Stage I fractures of the femoral neck during aspiration of the hemarthrosis. An increase in pO_2 indicating restoration of the blood flow was seen in 2 of the patients.

Several reports have recently dealt with the possibility that hemarthrosis and hyperpressure could cause avascular necrosis of the femoral head in undisplaced fractures, and therefore an aspiration should be considered (Wingstrand et al. 1986, Strömqvist et al. 1988, Crawfurd et al. 1988).

We studied intraosseous pO_2 in the femoral head during aspiration of the hemarthrosis in Garden Stage I fractures.

Patients and methods

From January 1987, 9 patients with Garden Stage I fractures were investigated. The median age was 84 (75–92) years. The median time from injury to measurement was 18 (12–24) hours.

The partial pressure of oxygen was measured continuously in situ by a quadruple mass spectrometer (Balzers, QMG 112, Liechtenstein) via a membrane-covered blood-gas catheter (Lundsgaard et al. 1980). During the operation, gaseous anesthetics were not used, and the patients were normoventilated with continuous monitoring of end tidal pO_2 and pCO_2. A bone cannula (inner and outer diameters 1.4 and 2.0 mm) was inserted through the major trochanter into the upper part of the femoral head under the guidance of an image intensifier. The cannula was flushed with a heparin solution to prevent clotting. The blood-gas catheter was introduced into the subchondral spongiose bone through the cannula. Intraosseous pO_2 was recorded with the hip in the neutral position (0° flexion). When the O_2 signal was stable, the hip joint was aspirated under the guidance of the image intensifier. For the next 10 min, pO_2 was recorded; and then fixation with a sliding hip screw was performed with the catheter in situ.

Results

The median volume of aspirate was 4 (1–7) mL. In 2 patients (nos. 2 and 8), from whom 3 and 7 mL were aspirated, there was an increase in pO_2 indicating restoration of blood flow (Table 1). The course has been uneventful for all the patients so far, 12–25 months after the injury

Table 1. Data for 9 patients with undisplaced femoral neck fractures

Case	Injury to aspiration (hours)	Aspiration volume (mL)	pO_2(torr)[a]				
			Before	After aspiration (min)			
				5	10	20	Mean
1	14	1	49	55	52	52	53
2	18	3	45	90	75	75	80
3	12	4	60	64	60	60	61
4	24	2	65	68	64	65	65
5	18	6	40	38	40	40	39
6	21	6	58	60	60	60	60
7	15	3	50	52	55	52	53
8	20	7	45	50	68	65	61
9	16	5	65	64	64	65	64
Mean	18	4	53	50	60	59	60

[a] Normal values: 63 ± 5 torr (Kiær et al. 1988).

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Discussion

The risk of developing avascular osteonecrosis will depend on the duration of the ischemia and the vascular damage (Hungerford and Zizic 1983). An intracapsular tamponade of several hours may cause secondary vascular damage, which could explain why we found restoration of the blood flow in only 2 patients. Perhaps longer recordings would have revealed an increase in pO_2 in other patients with reduced femoral blood flow. In scintimetric studies by Strömqvist et al. (1988), several hours elapsed between the aspiration and the secondary scintimetry. This could explain why they found a marked increase in uptake after the aspiration in 9 out of 13 patients.

We did not measure the intracapsular pressure because the hemarthrosis was confirmed by aspiration, and removal of even a very small amount would have changed the pressure exponentially. Reinstillation of the blood followed by pressure measurement and a new aspiration could have interfered with the intraosseous blood flow. Measurements in the major trochanter, which could have served as a reference, had been omitted to avoid the decompression a second cannula in the trochanter could have caused.

References

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