The erythrocyte sedimentation rate following exchange of infected total hips

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Seventy-six patients without other diseases affecting the erythrocyte sedimentation rate (ESR) underwent exchange of an infected total hip. The ESR before the exchange arthroplasty averaged 53 mm/h. ESR values at 6 weeks, 3 and 6 months after the exchange operation were lower in 60 patients in whom the infection healed than in 16 patients whose infection had not healed. From 3 months after the exchange operation and onwards, the ESR averaged less than 20 mm in healed cases compared with more than 30 mm in still infected cases. An ESR equal or less than 30 mm after 6 months – observed in 48/53 healed cases – implied a good prognosis.

The postoperative erythrocyte sedimentation rate (ESR) is higher in infected compared with non-infected primary total hip replacements; in non-infected cases the ESR returns to slightly above the preoperative level within three to six months (Carlsson 1978, Forster and Crawford 1982). I have studied the ESR after the exchange of infected total hips to assess the predictive value of this simple test with respect to the healing of the infection.

Patients and methods

Between 1974 and 1981, 108 patients with bacteriologically proven deep total hip infection were operated on by extraction of the prosthesis and the insertion of a new prosthesis using gentamicin-impregnated bone cement (Sanzén et al. 1987). Systemic antibiotics were given for 6 (1–12) months after the exchange operation. The operations were performed at the Departments of Orthopedics in Gävle, Lund, and Malmö, Sweden. Excluded were 8 patients who died before the minimum 2-year observation time and 15 patients with either a local or systemic disease affecting the ESR or with an infection in the other hip. Of the remaining 85 patients, 76 were included with at least three ESR determinations (Westergren 1926) performed at approximately 1.5, 3, 6, or 12 months postoperatively. In two-stage exchange arthroplasties, the Girdlestone period exceeded 6 weeks in 12 of 22 cases with a median of 41 (10–186) weeks. The ESR value obtained before the second stage of the operation was recorded as preoperative in these 12 cases.

In 16 patients the infection was not considered healed after the exchange operation, which was performed at a median age of 66 (58–76) years. The conclusion that these infections were not healed was based on clinical and bacteriologic findings in an additional exchange operation (5 patients) or in a resection arthroplasty (6 patients). Two other patients were treated for abscesses and 1 with a revision of a fistula. At 5 years postoperatively, 1 patient had a sudden onset of hip pain and a steep rise of ESR and C-reactive protein. Finally, 1 patient had hip pain when the antibiotic treatment was stopped, but became free of pain when antibiotic treatment was started again.

During the first postoperative year, persistent infections were treated by minor surgical procedures in 5 cases, a second exchange operation in 1 case, and a Girdlestone procedure in 1 case.

In the healed group of 25 men and 35 women, the median age at the exchange arthroplasty was

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Table 1. The ESR (mm in the first hour) in 76 patients with infected total hip replacements before and after exchange arthroplasty

		Before	After (mo)			
			1,5	3	6	12
Healed infections	n	60	34	48	53	52
	range	1–165	4–70	2–55	2–38	3–44
	mean	53	24	17	16	17
	SD	31	14	10	10	10
	SE	4	2	2	1	1
P-value[a]		0.94	0.0003	0.032	0.0012	0.204
Nonhealed infections	n	16	10	15	15	14
	range	7–104	10–125	3–87	8–70	3–90
	mean	52	61	34	34	32
	SD	31	30	25	20	29
	SE	8	10	7	5	8

[a] Mann-Whitney rank-sum test of the ESR in patients with healed and nonhealed infections.

65 (28–80) years and the follow-up period was 6 (2–10) years.

The Mann-Whitney rank-sum test, Fisher exact probability test, and the paired *t*-test were used.

Results

In patients with healed infections the ESR already 6 weeks after the exchange operation was lower than before ($P < 0.001$). In patients with infections that did not heal, there was an insignificant increase of the ESR after 6 weeks. After 3, 6, and 12 months, the average ESR was above 30 mm in nonhealed cases and below 20 mm in patients with healed infections (Table 1).

ESR determinations 6 months after the exchange arthroplasty were available in 68 of 76 cases. An ESR not exceeding 30 mm was found in 55 of these patients and in 48 the infection was eradicated. On the other hand, the infection healed in only 5 out of 13 patients with an ESR above 30 mm ($P = 0.0013$). At 6 months, the highest observed value in a patient with a healed infection was 38 mm.

Four of the 16 nonhealed patients had a low ESR postoperatively, an uneventful clinical course, and were initially regarded as healed. However, in 3 of these cases a sudden relapse of the infection occurred after 3–5 years. The fourth case produced positive bacteriologic cultures at revision after 5 years for a suspected mechanical loosening.

Discussion

The normal values of the ESR vary considerably, especially in women (Böttiger and Svedberg 1967). In a Swedish population study, it was found that 13 percent of women aged between 54 and 60 years had an ESR above 30 mm. An apparent cause of the elevated ESR was found in only about half of these women. The mean annual increase in ESR was 0.6 mm (Rafnasson et al. 1979). In a Finnish population sample of males over 50 years of age, the limits for the 95 and 97.5 percentiles of the ESR were 27 and 36 mm, respectively (Näyhä 1987).

Following an uncomplicated total hip operation, the ESR increases substantially during the first month and then decreases to a level slightly above the preoperative value (Aalto et al. 1984). In different populations the ESR 1 year after THR averages 15 mm (Carlsson 1978), 20 mm (Forster and Crawford 1982), and 30 mm (Aalto et al. 1984). The wide range of the ESR in our patients both with and without an infected total hip prosthesis leads to an overlapping of the ESR values between these groups as reported by Forster and Crawford (1982). In our cases, five of 13 ESRs above 30 mm 6 months postoperatively occurred in patients with a healed infection, the highest of these values being 38 mm. Comparing the postoperative ESR values with those obtained before the primary operation is important when ESRs of individual patients are evaluated. It has been shown that patients with an uncomplicated hip operation and a high preoperative ESR continues postoperatively to have a high ESR (Forster and Crawford 1982). Also, 6 months postoperatively, none of 75 patients with a noninfected primary total hip operation had an ESR more than 15 mm above the preoperative value (Carlsson 1978).

Seven of our patients with infection classified as not healing did not have an ESR above 30 mm 6 months postoperatively. Therefore, the sensitivity, i.e., the probability of an increased ESR when the infection did not heal or recurred, was low (8/15=0.53). This can, to some extent, be an effect of the postoperative antibiotic treatment.

Clegg (1977) reported on 29 infected total hip replacements treated with a Girdlestone resection. On examination after 1–6 years, he found that 20 of 24 healed cases had a normal ESR, whereas in 4 of 5 cases with a continuing sepsis the ESR still exceeded 30 mm. Similarly, in this study the specificity, i.e., the probability of an ESR not exceeding 30 mm in patients with a healed infection was fairly high (48/53=0.91). The negative predictive value of an ESR not exceeding 30 mm 6 months postoperatively was 0.87 (48/55). This is of great value because many patients still have some complaints of minor pain in the hip region 6 months after an exchange operation, and if the ESR does not exceed 30 mm the possibility of a persistent infection is small.

After the exchange operation, the ESR decreased rapidly in our healed cases. This decrease was comparable to the ESR changes, or even faster than the changes, after uncomplicated primary operations reported by Forster and Crawford (1982) and Aalto et al. (1984). Forster and Crawford (1982) also reported on a series of 12 successfully exchanged infected total hips in which the ESR had dropped significantly after 4 months.

A possibly more sensitive laboratory test than the ESR to detect infectious complications after hip operations is C-reactive protein (CRP). This acute phase reactant increases rapidly after a THR and is normalized (level below 10 mg/L) in uncomplicated cases within 3 weeks (Aalto et al. 1983). In a study of chronic staphylococcal osteomyelitis, CRP showed a good correlation with the clinical activity of the infection. CRP determination also revealed exacerbations of the osteomyelitis before clinical signs appeared and was more reliable than the ESR in this respect (Hedström 1983).

In many cases the persistence of infection becomes evident early after an exchange arthroplasty. On the other hand, a successful eradication of the infection is not obvious during the first year postoperatively. Because a rapid decrease of the ESR after an exchange arthroplasty to levels below 30 mm after 6 months indicates a good prognosis in the majority of cases, serial ESR determinations following this demanding surgical procedure is recommended.

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