

## Short communication

# Reduction in haemoglobin after knee joint surgery

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Judicious surgical intervention has revolutionized the management of the chronic rheumatic diseases in the last decade (Shiers, 1960; MacIntosh and Hunter, 1972; Wilson, 1972). Both reconstructive and palliative surgery have proved to be of great value in the management of patients with these disorders and these operations are today becoming commonplace. Both the indications for and the untoward effects of these operative procedures are becoming more clearly defined, and such complications as infection, loss of joint mobility, loosening of a prosthesis, and the local calcification are well recognized (Roles, 1971; Anderson, Freeman, and Swanson, 1972; Dupont and Charnley, 1972; Miller, 1972). Clearly, also, these operations carry with them the potential hazard of any anaesthetic and of the usual kind of postoperative problems such as deep venous thrombosis, pulmonary infection, or fat embolus.

It is the purpose of this present short report to describe a further complication which would appear to be particularly common in certain orthopaedic procedures, namely a sudden postoperative reduction in haemoglobin concentration. To our knowledge little attention has been focused upon this problem, and, since many of the patients concerned are suffering from chronic diseases such as rheumatoid arthritis in which the pre-operative haemoglobin concentration itself may be low, this finding has profound clinical significance. The initial observation by one of the authors (E.P.) was that after a Shiers arthroplasty there seemed to be a marked reduction in postoperative as compared with preoperative haemoglobin concentration. Accordingly a small survey was conducted in which the pre- and postoperative haemoglobin concentrations in groups of patients undergoing different orthopaedic operations were recorded and the results are presented in this paper.

### Material and methods

85 patients suffering from classical or definite rheumatoid arthritis (A.R.A. criteria), all of whom had undergone operations at the Centre for Rheumatic Diseases in the previous year, were studied. Of these patients, 24 had received a Shiers arthroplasty (4 males, 20 females; mean age 54 yrs  $\pm$  3.2 S.E.M.; mean duration of arthritis 13.8  $\pm$  1.9 yrs); twenty had received a McIntosh prosthesis (6 males, 14 females, mean age 51.6 yrs  $\pm$  2.8 S.E.M.; mean duration of arthritis 9.2  $\pm$  1.4 yrs), and 21 had received anterior knee joint synovectomy (6 males, 15 females; mean age 49.8 yrs  $\pm$  2.4 S.E.M.; mean duration of arthritis 11.3  $\pm$  2.3 yrs). These patients were selected consecutively in a retrograde fashion dating from the original observation and were not further selected in any way.

In Table I the clinical details of the groups of patients studied are shown. It can be seen that these patients had severe rheumatoid arthritis denoted by the high articular indices and high erythrocyte sedimentation rate. The reduction in haemoglobin concentration (Cynamet Haemoglobin method) after operation in these groups of patients was compared with a group of 20 patients who had undergone supracondylar osteotomy of the knee. The average age of this group of patients was 51.2 yrs  $\pm$  2.7 S.E.M. and four were male.

### Results (Table II)

Table II shows that the mean preoperative haemoglobin in the case of the patients who had had a Shiers arthroplasty (mean 12.4 g. per cent.  $\pm$  0.28 S.E.M.) was significantly higher than the corresponding value obtained after the operation (mean 10.2 g. per cent.  $\pm$  0.24 S.E.M.;  $t = 10.5$ ;  $P < 0.001$ ; percentage reduction = 17.7).

In the case of the patients who had had a synovectomy, the mean preoperative haemoglobin (mean

**Table I** Clinical particulars of 85 patients

Group	Sex			Age (yrs)	Duration of arthritis (yrs)	Articular index	Erythrocyte sedimentation rate	Rheumatoid factor	Complicating disease	Postoperative complications
	No. of cases	M	F							
Shiers arthroplasty	24	4	20	54.0 ± 3.2	13.8 ± 1.9	15.4 ± 2.8	47.6 ± 4.9	264 ± 115	1	5
Synovectomy	21	6	15	49.8 ± 2.4	11.3 ± 2.3	10.6 ± 2.3	56.8 ± 5.7	226.3 ± 74.9	1	0
McIntosh arthroplasty	20	6	14	51.6 ± 2.8	9.2 ± 1.4	11.6 ± 2.9	44.6 ± 6.7	125.6 ± 55.5	2	0
Osteotomy	20	4	16	51.2 ± 2.7	12.2 ± 2.5	9.4 ± 2.0	53.9 ± 7.9	147.2 ± 54.7	1	0

**Table II** Results of haemoglobin investigations

Group	Haemoglobin (g. per cent.)		t (mean 4)	P	Per cent. reduction
	Preoperative	Postoperative			
Shiers arthroplasty	12.4 ± 0.28	10.2 ± 0.24	10.5	P < 0.001	17.7
Synovectomy	12.3 ± 0.3	11.5 ± 0.3	0.35	P > 0.1	6.5
McIntosh arthroplasty	12.5 ± 0.3	11.2 ± 0.36	9.6	P < 0.001	10.4
Osteotomy	12.0 ± 0.3	10.7 ± 0.3	2.3	0.05 > P > 0.02	10.8

12.3 g. per cent. ± 0.3 S.E.M.) did not differ significantly from the postoperative value (mean 11.5 g. per cent. ± 0.3 S.E.M.).

In the patients who had had McIntosh arthroplasty there was a significant drop from a mean preoperative value of 12.5 g. per cent. ± 0.3 S.E.M. to a mean postoperative value of 11.2 g. per cent. (± 0.36 S.E.M.;  $t = 9.6$ ;  $P < 0.001$ ; percentage reduction = 10.4).

In these patients who had had a femoral supracondylar osteotomy there was a significant reduction from a mean preoperative value of 12 g. per cent. ± 0.3 S.E.M. to a mean postoperative value of 10.7 g. per cent. ± 0.3 S.E.M. ( $t = 2.3$ ;  $P < 0.05$ ; percentage reduction = 10.8).

It will also be seen that the mean value in each of the groups of patients studied preoperatively was within normal limits.

## Discussion

It would seem from the results presented in this paper that a significant reduction in haemoglobin concentration is not an infrequent finding when patients undergo a Shiers arthroplasty or a McIntosh arthroplasty. The magnitude of this reduction, particularly in the case of the Shiers arthroplasty, is considerable. Since 1 g. haemoglobin represents 1.34 ml. oxygen-carrying capacity, it is obvious that this percentage change in haemoglobin is of considerable clinical importance. The reason for this reduction in haemoglobin concentration is not immediately apparent. All of the patients who underwent a Shiers knee replacement suffered from rheumatoid arthritis and were operated on by the

same person (K.P), whose practice it is to insert two intra-articular drains. The mean blood loss in the three groups of patients was not considerable. In the case of the Shiers arthroplasty the mean value was 340 ml. (± S.E.M. 69) It is inconceivable that this volume of blood loss would account entirely for a reduction of haemoglobin concentration of the magnitude detected in the Shiers arthroplasty and the McIntosh arthroplasty groups of patients. The preoperative haemoglobins were estimated within 3 days of operation and the postoperative haemoglobins on the third day after operation. This time difference precludes any failure of red cell production. The possibility that a haemolytic or redistribution process underlies this phenomenon is at present under investigation. This phenomenon, however, seemed important enough to the authors of this paper to justify bringing it to the attention of the medical profession before studying its pathogenesis in detail.

## Summary

The mean percentage differences between immediately preoperative and immediately postoperative haemoglobin concentrations were 17.7, 10.8, 10.4, and 6.4 per cent. for rheumatoid arthritis patients undergoing Shiers arthroplasty, supracondylar osteotomy, McIntosh arthroplasty, and synovectomy of the knee joint respectively. These differences underline the importance of monitoring haemoglobin values preoperatively.

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## References

- ANDERSON, G. B. J., FREEMAN, M. A. R., AND SWANSON, S. A. V. (1972) *J. Bone Jt Surg.*, **54B**, 590 (Loosening of the cemented acetabular cup in total hip replacement)
- DUPONT, J. A., AND CHARNLEY, J. (1972) *Ibid.*, **54B**, 77 (Low friction arthroplasty of the hip for the failures of previous operations)
- MACINTOSH, D. L., AND HUNTER, G. A. (1972) *Ibid.*, **54B**, 244 (Use of the hemiarthroplasty prosthesis for advanced osteoarthritis and rheumatoid arthritis of the knee)
- MILLER, A. J. (1972) *Ibid.*, **54B**, 600 (Late fracture of the acetabulum after total hip replacement)
- ROLES, N. C. (1971) *Proc. roy. Soc. Med.*, **64**, 636 (Infection in total prosthetic replacement of the hip and knee joints)
- SHIERS, L. G. P. (1960) *J. Bone Jt Surg.*, **42B**, 31 (Arthroplasty of the knee)
- WILSON, F. C. (1972) *Ibid.*, **54A**, 1429 (Total replacement of the knee in rheumatoid arthritis)