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Blood loss in total hip arthroplasty for rapidly destructive coxarthrosis

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Abstract We studied the perioperative blood loss in 100 total hip arthroplasties performed for rapidly destructive coxarthrosis and compared it with the blood loss in 100 total hip arthroplasties for regular coxarthrosis. The treatment protocol was identical in both groups. Total blood loss was calculated as the compensated blood loss (volume transfused during and immediately after surgery) and the non-compensated blood loss using Nadler and Mercuriali formula. The mean blood loss calculated in milliliters of red blood cells (100% haematocrit) was 578 ml in regular coxarthrosis and 945 ml in rapidly destructive coxarthrosis. The blood loss after total hip arthroplasty is greater when surgery is performed for rapidly destructive coxarthrosis than for regular coxarthrosis ($P < 0.001$).

Résumé Nous avons étudié la perte sanguine dans 100 arthroplasties totales de hanche exécutées pour coxarthrose destructrice rapide et l'avons comparé avec la perte sanguine dans 100 arthroplasties pour coxarthrose habituelle. Le protocole du traitement était identique dans les deux groupes. La perte sanguine totale a été calculée comme la perte sanguine compensée (le volume à transfuser pendant et immédiatement après chirurgie) et la perte sanguine non – compensée en utilisant la formule de Nadler et Mercuriali. La perte moyenne, calculé en ml de cellules de sang rouge (100% d'hématocrite) était de 578 ml dans la coxarthrose habituelle et de 945 ml dans la coxarthrose destructrice rapide. La perte sanguine après arthroplastie de hanche est plus importante quand la chirurgie est exécutée pour coxarthrose destructrice rapide que pour coxarthrose habituelle ($P < 0.001$).

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Introduction

Rapidly destructive coxarthrosis (RDC) has been defined by clinical, radiological, anatomical and pathological criteria [5, 6, 10]. Its relationship with regular coxarthrosis is still poorly understood. RDC is seen in between 5 and 10% of all coxarthroses [4, 10], and almost always requires an arthroplasty. Nevertheless, the specific results of implant surgery cannot be precisely determined from studies performed before 1975 and including different implant types [3, 9, 10].

Arthroplasty in such cases often results in more bleeding than the regular coxarthrosis. In order to adapt our transfusion strategy and patient information better, we felt it useful to evaluate the blood loss during and immediately after arthroplasty performed for RDC and compare it with the blood loss in hip replacements for regular coxarthrosis.

Materials and methods

Retrospectively we evaluated the blood loss in 200 total hip replacements performed between January 1994 and December 1998. This included 100 arthroplasties performed for RDC and an equal number performed for regular coxarthrosis (either primary or secondary to dysplasia, excluding osteonecrosis and inflammatory arthritis).

We defined RDC by its radiographic development associating the rapid development of a chondrolysis leading to the disappearance of the joint line in less than 18 months followed by osteolysis [2, 9]. In all cases the diagnosis was confirmed histopathologically by osteochondral debris impacted in the articular capsule, and by important growth of pseudoangiomatous connective and vascular buds in the femoral head [5].

None of the patients had any known anomaly of hemostasis and none of the hips had been operated upon previously. No platelet anti-aggregant and/or anti-inflammatory agents were administered in the preoperative period (at least 10 days before surgery). The protocol of thromboembolic prophylaxis was identical in both groups, with low molecular weight heparin in doses of 5000 IU anti-Xa/24 h, with half-doses administered 12 h before surgery.

The characteristics of each group are given in Table 1. All patients were operated on under general anesthesia by using a trans-trochanteric approach. The implant used was a Charnley-Kerboull

Table 1 Characteristics of subject groups

	Regular coxarthrosis	Rapidly destructive coxarthrosis
Ratio men/women	47/53	14/86
Mean age (years)	63 (± 10)	71 (± 8)
Mean overweight (%) [*]	21.4 (± 6)	10.2 (± 17)
Mean duration of surgery (min)	117 (± 33)	119 (± 29)
Patients operated on by the most experienced surgeons	59	56

* Reference was ideal weight calculated with Lorenz's formula: ideal weight=(Height-100)-(Height-150)/2 for women, 4 for men. Most experienced surgeons had performed more than 100 arthroplasties per year for at least 10 years; others had performed between 20 and 60 per year for 1 to 5 years

Table 2 Evaluation of blood loss (Nadler [8] and Mercuriali [7])

Total blood loss (ml of erythrocytes; 100% hematocrit)	=Compensated blood loss+non-compensated blood loss
Compensated blood loss (ml)	=Number red blood cell units \times ml red blood cells per red blood cell unit (150 ml for units used)
Non-compensated blood loss (ml):	=Total blood volume \times (Hematocrit at D1-Hematocrit at D5 or D7)
Total blood volume (ml):	In men=604+0.0003668 \times [Height (cm)] ³ +32.2 \times Weight (kg) In women=183+0.000356 \times [Height (cm)] ³ +33 \times Weight (kg)

Table 3 Mean blood loss (ml of erythrocytes; hematocrit 100%)

	Regular coxarthrosis	Rapidly destructive coxarthrosis
Per- and postoperative compensation	238+38=276 (± 159)	633+174=807 (± 267)
Non-compensated blood loss	302 (± 199)	138 (± 194)
Total blood loss	578 (± 239)	945 (± 286)

cemented prosthesis. No bone reconstruction was necessary. A postoperative suction drainage (800 millibars) was systematically used with three drains: one in the joint, one in the muscular mass and one subcutaneous. The drains were left for 72 h. Postoperative blood transfusions were usually decided upon, case by case, using hemoglobin and hematocrit values and according to the subjective appreciation of the patient's tolerance to anemia.

The volume of lost blood was calculated as the compensated blood loss (perioperative transfused blood) plus the non-compensated blood loss estimated from pre- and postoperative hematocrit levels, using the formulae established by Nadler [8] and Mercuriali and Inghilleri [7] (Table 2). For comparison the blood loss was calculated in milliliters of red blood cells (100% hematocrit).

Results were compared using for the comparison of quantitative and qualitative variables the Student's *t*-test and Student-Fisher methods (for subgroups of less than 30), and the correlation coefficient method with a 5% significance threshold ($P < 0.05$) for the comparison of quantitative variables.

Results

The total blood loss was significantly greater in arthroplasty performed for RDC ($P < 0.001$). Calculated in milliliters of red blood cells (100% hematocrit) the blood loss was 945 ml for the RDC group and 578 ml for the regular coxarthrosis group (Table 3). Using a mean hematocrit level of 35%, the total blood loss was 2700 ml and 1651 ml, respectively.

In the RDC group the compensated blood loss was 5.38 red blood cell units compared with 1.84 units in the regular group. All patients operated on for RDC required

blood compensation compared to only 84 patients with regular coxarthrosis. In the immediate follow-up of this compensation, the residual blood loss was found to be lower in the RDC group.

Sex, age and extra body weight had no significant effect on bleeding, either in the RDC group or in the 200 patients taken together. The duration of the procedure had no impact on the loss of blood. It was lower in both groups when surgery had been performed by the most experienced surgeons ($P < 0.001$). The experience of the surgeon had no significant effect on blood loss, either in the RDC group or in the 200 patients taken together, while it reduced the bleeding in the regular coxarthrosis group ($P = 0.01$).

Discussion

While the viral and immunological risk associated with homologous blood transfusion has been greatly reduced, many techniques have been developed to minimize its use. Whether this strategy uses hemodilution, erythropoietin, blood salvage or autologous transfusion, it must be of help to anticipate the amount and tolerance of bleeding. Total hip replacements irrespective of operative technique, always generate an important blood loss. As shown by our results, this loss varies with different parameters, among which is the initial lesion of the hip.

Our results are consistent with those found in the literature [1, 11]. Like these authors, we found no correlation between weight, age, duration of the surgical procedure and blood loss; we observed, however, a generally greater blood loss in men. The consequences of the various technical options such as approach or type of fixation of the implants are difficult to determine from the comparison of results obtained with different methods. Nevertheless, it seems that the mean blood loss after transtrochanteric arthroplasty, i.e., 1651 ml is similar to that observed by Trice et al. [11] in arthroplasty using a transmuscular approach, i.e., 1624 ml.

In patients with RDC, blood loss was significantly greater while none of the patient's characteristics had a significant effect. In this group, the relatively low number of men operated on for RDC might explain the fact that sex had no effect. An important blood loss and the poor tolerance for blood depletion observed in older subjects routinely required transfusion. In most cases, the transfused volume went beyond the possibility of compensation by an autologous transfusion because its volume was limited by the terrain itself and by the frequent haste with which these arthroplasty are planned and performed. All this indicates that it seems wise to inform these patients that a homologous transfusion will probably be necessary.

Several difficulties related to the method limit the interpretation of our results, which, to our knowledge, are the only published data on increased blood loss in arthroplasty performed for RDC. The present study cannot explain the hemorrhagic nature in arthroplasty performed for RDC. The frequent observation during surgery of a tumescent and congested synovial membrane, and the pseudoangiomatous hypervascularisation of the bone tissue found at histopathological examination evokes the role of inflammatory alterations, especially a local vasodilatation, but this remains difficult to demonstrate. For this reason, a comparative study of the blood loss associated with THAs in patients with various inflammatory

and degenerative disorders is currently carried out. Furthermore, it would also be useful to evaluate the possibility of using a preoperative anti-inflammatory therapy to reduce the blood loss in this not infrequent disorder.

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