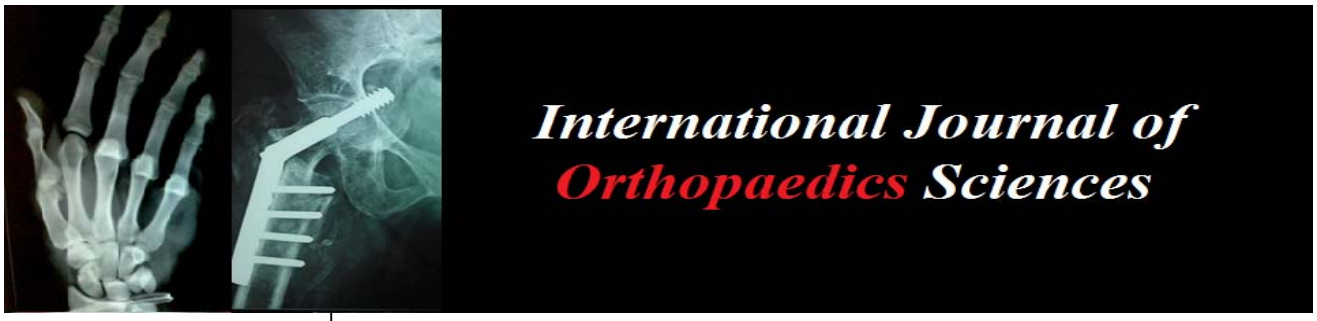

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Pre-operative group and save for elective total knee Arthroplasty: Is it indicated?

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Abstract
Background: Total knee arthroplasty (TKA) is a commonly performed surgical procedure in UK. Routine use of tourniquets and tranexamic acid raises the question of whether pre-operative group and save (G&S) is necessary.
Methods: Retrospective review of 100 patients who underwent TKA. We reviewed if G&S was performed as part of pre-operative assessment and cost of doing so, whether a tourniquet and tranexamic acid were administered, change in haemoglobin (Hb) concentration, and whether blood transfusion was required. We also investigated the time taken to provide type specific and fully cross-matched blood in an emergency, for patients with and without pre-operative G&S sample.
Results: Tranexamic acid and tourniquets were used in all cases. Mean drop in Hb was 15.1 g/l. In 48-hour post-operative period, none of patients received any intraoperative blood transfusions.
Conclusion: Pre-operative G&S results in only a minimal reduction in time to availability of blood products. In emergency situation, O negative blood can be administered immediately with or without a pre-operative sample. None of the cases required blood transfusion suggesting that pre-operative G&S represents a financial burden. There is minimal benefit to be gained from pre-operative G&S for elective TKA. Although further assessment is necessary, we advocate that G&S could be safely omitted.

Keywords: Total knee arthroplasty, group and save, post-operative blood transfusion

1. Introduction
Total knee arthroplasty (TKA) is one of the most commonly performed surgical procedures in the United Kingdom with almost 100,000 completed in 2014. The majority of joint replacements are performed in the over 65-age group for the treatment of osteoarthritis. However, it may be indicated for management of other arthropathies such as rheumatoid arthritis and gout, or following significant knee trauma. Variations in types of joint replacement and technique exist, but basic principles of the operation remain constant.
Elective joint replacement surgery is increasingly performed as part of an enhanced recovery pathway (ERP) which has been shown to improve the quality of patient care [1, 2]. This involves a multi-disciplinary team based approach to optimise every step of a patients' pathway in order to accelerate post-operative recovery, reduce complications, adverse events, and general morbidity [3]. Pre-operative assessment involves a thorough work-up to evaluate and optimize any medical conditions that may increase risk of intra-operative or post-operative complications. This routinely involves clinical assessment, blood tests and electrocardiogram. A blood sample for Group and Save (G&S) is routinely performed to ensure blood products can be made rapidly available should they be required. This policy is followed in our trust.
Peri-operative and intra-operative interventions are employed as part of the ERP with the aim of optimizing anaesthesia, using atraumatic and minimally invasive surgical techniques, reducing surgical times, and maintaining normovolaemia, normothermia and preventing hypoxia [3, 4]. It is common practice to use a tourniquet when performing TKA. Meta-analyses have confirmed benefits of the maintenance of a bloodless field and therefore an improved bone-cement interface [4], and a reduced surgical time [5]. The evidence suggests a reduction in intraoperative and total blood loss when a tourniquet is used [4] although this remains controversial.

Peri-operative intravenous administration of tranexamic acid has also been shown to be of benefit in TKA, with a reduced need for blood transfusion without an increase in rate of complication [6]. Our hospital follows both these interventions for all patients on the enhanced recovery programme.

Whilst these techniques are being used, we questioned whether pre-operative G&S is necessary in this patient group. We sought to review if G&S was performed as part of pre-operative assessment and the cost of doing so, whether a tourniquet and tranexamic acid were administered, the change in haemoglobin concentration and the rate of blood transfusion following TKA.

2. Methods

The first 100 patients to undergo elective TKA in our trust in 2014, a large district general hospital, were identified from the ERP records. The hospital pathology results system was used to determine whether pre-operative group and save was performed. Pre-operative and post-operative haemoglobin concentration was recorded with any change calculated. Operative records were reviewed to identify whether tranexamic acid was administered and if a tourniquet was used. Transfusion records were requested from the blood transfusion department to identify which, if any of the patients had required transfusion in the 48-hour post-operative period. We also requested the time taken to provide type specific and fully cross-matched blood in an emergency for a patient with and without a pre-operative group and screen sample.

3. Results

Of the 100 patients reviewed, all had pre-operative group and save requested. 93% had a post-operative full blood count. Tranexamic acid and a tourniquet were used in all cases. The mean drop in haemoglobin was 15.1 g/l. In the 48-hour post-operative period, none of the 100 patients received blood transfusion. Estimates for the cost of group and save range from £2.20 to £4.58 in previously published studies [7]. The cost of a routine group and save is £12 in our trust and omission of this test in these patients would have saved £1200. This amounts to £1,200,000 of potential savings when extrapolated to all 100,000 TKAs performed in the UK per year.

Times for provision of blood products were variable depending on whether there were any abnormal antibodies present (Table 1).

Table 1: Time for provision of blood products

	Current pre-operative G&S Available	No current pre-operative G&S available
Emergency O- blood	Immediate	Immediate
Group Specific blood	Immediate	Within 10 minutes of sample receipt
Cross matched blood no atypical antibodies	Approx. 15 minutes if only 1 sample received Approx. 5-10 minutes if 2 samples received	Within 1 hour
Cross matched blood atypical antibodies present	Usually within 1 hour	>2 hours May require referral to reference center if complex

4. Conclusions

Total knee arthroplasty is a common elective procedure with approximately 300 performed in our trust per year. Pre-operatively, all patients' undergo a health assessment and have routine blood tests including a group and save. All TKAs are performed following administration of tranexamic acid and with an above knee tourniquet in place to ensure a bloodless field and reduce blood loss.

The results demonstrate that average blood loss during TKA is usually low. There is likely to be a dilutional element to any drop in haemoglobin observed due to intra-operative and post-operative fluid administration but this would require closer review. None of the cases reviewed required blood transfusion post-operatively suggesting pre-operative group and save presents a significant financial burden and is of a questionable value. Assuming similar practice in other trusts nationwide and based on National Joint Registry figures, this could provide savings of up to £ 1,200,000 per annum. Current practice in our trust is for a single group and save sample to be requested pre-operatively. However, the most recent guidelines for pre-transfusion compatibility testing outlined by the British Blood Transfusion Society advise that two samples should be provided except in an emergency situation to reduce the risk of transfusion reaction [8].

The balance between cost and patient safety factors must be considered. Inadvertent vascular injury may require urgent administration of blood products. However, pre-operative group and save results in only a minimal reduction in time to availability of blood products. In the emergency situation, O negative blood can be administered immediately with or without a pre-operative sample. The latest anaesthetic guidelines for blood transfusion suggest that transfusion is only strongly indicated if haemoglobin concentration is less than 7 g/dL. A drop to this level would be unexpected assuming appropriate pre-operative assessment and proficient surgical technique.

If a transfusion is required postoperatively it would take 1 hour to issue crosshatched blood, a delay that would unlikely compromise patient safety. Both surgical and anaesthetic team members may be resistant to changes in practice. However, we have demonstrated that there is minimal patient benefit to be gained from pre-operative group and save for elective TKA and there is potential for significant financial saving. Although further assessment is necessary we would advocate that this investigation could be safely omitted in this patient group. Larger studies are required to ensure patient safety.

5. Compliance with Ethical Standards

The authors declare that they have no conflict of interest.

This study did not involve any human participants or animal.

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