Factors affecting wound ooze in total knee replacement

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ABSTRACT

INTRODUCTION Wound ooze is common following total knee arthroplasty (TKA) and persistent wound infection is a risk factor for infection, and increased length and cost of hospitalisation.

PATIENTS AND METHODS We undertook a prospective study to assess the effect of tourniquet time, peri-articular local anaesthesia and surgical approach on wound oozing after TKA.

RESULTS The medial parapatellar approach was used in 59 patients (77%) and subvastus in 18 patients (23%). Peri-articular local anaesthesia (0.25% Bupivacaine with 1:1,000,000 adrenalin) was used in 34 patients (44%). The mean tourniquet time was 83 min (range, 38–125 min). We found a significant association between cessation of oozing and peri-articular local anaesthesia ($P = 0.003$), length of the tourniquet time ($P = 0.03$) and the subvastus approach ($P = 0.01$).

CONCLUSIONS Peri-articular local anaesthesia, the subvastus approach and shorter tourniquet time were all associated with less wound oozing after total knee arthroplasty.

KEYWORDS

Total knee arthroplasty – Wound ooze – Tourniquet – Subvastus approach

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Total knee arthroplasty (TKA) is a common procedure, with 52,329 procedures performed in England and Wales in the year 2008.¹ Wound ooze is inevitable during healing but, if persistent, is a risk factor of infection, increased length and cost of hospitalisation after total knee arthroplasty.² There are no data on factors associated with wound oozing after total knee arthroplasty. We performed a prospective study to assess the significance of tourniquet time, use of local anaesthesia, and the surgical approach on wound oozing after total knee arthroplasty.

Patients and Methods

Seventy-seven consecutive patients undergoing primary TKA over a 3-month period were recruited in our study. The body mass index (BMI) was calculated. The procedures were carried out by five surgeons. Two surgeons routinely used the subvastus approach and the remainder a medial parapatellar. Tourniquets were used in all patients. The two surgeons, who used the subvastus approach, released the

tourniquet before wound closure. The remainder did so after application of dressing. In 34 patients, 60 ml of 0.25% Bupivacaine with 1:1,000,000 adrenalin was injected into the peri-articular tissues during the surgical procedure.

This study had no effect on the standard peri-operative management and thromboprophylaxis. Sixty-nine patients were on 75 mg of aspirin once a day for 6 weeks, six patients were on Clexane 40 mg subcutaneous once a day until discharge and two patients were on warfarin as per INR (International Normalised Ratio). All patients had TED (Thrombo-Embolitic Deterrent) stockings until discharge and foot pumps for 24 h.

Field block technique

Bupivacaine (60 ml 0.25%) with 1:1,000,000 adrenaline (Antigen International Ltd, Roscrea, County Tipperary, Ireland) was administered. A standard 21-gauge needle was used to inject the local anaesthesia as follows. Before the components were inserted, 20 ml was systematically injected through and just posterior to the posterior capsule, at

four points, to achieve even distribution. Care was taken to aspirate before injection to avoid intravascular injection. Another 20 ml was injected into the rest of the deep tissues, including the quadriceps tendon and collateral ligaments and the remaining 20 ml injected into the subcutaneous tissues around the wound edges.

The surgical wound was inspected daily by the same observer. The wound was considered to be actively oozing if the dressing was soaked by more than 2 cm and if surgical wound was not oozing fluid. Spotting of 1 cm or less on the dressing site was not considered to be active ooze. The standard cut-off for wound dryness was 4 days.

The variables recorded were peri-articular local anaesthesia, surgical approach, tourniquet time, BMI, ASA grade, deep venous thrombosis prophylaxis (DVT) and wound length.

Statistical analysis

A graph was constructed to show the relationship between time to dryness and length of the tourniquet time. A straight line was constructed that had the best fit to these data by using the method of least squares. The slope of the curve was calculated and its standard error was calculated by using linear regression analysis.

The method of linear regression analysis was used in order to model the relationship between these variables by calculating the slopes, their standard error and correlation coefficients.

The null hypothesis was tested (*t*-test) and it was proven that the correlation coefficient was equal to zero.

The relationship between time to dryness and peri-articular local injection and subvastus approach was also compared. A Spearman rank test was used to estimate the correlation between those variables. A *t*-test was used in the end to test the null hypothesis (the correlation coefficient was equal to zero).

Results

Of the 77 patients in our study, there were 31 males (40%) and 46 females (60%). The mean age of patients was 71 years (range, 43–88 years). The mean BMI of the patients was 33 kg/m² (range, 21–54 kg/m²). Seven patients (9%) had an ASA grade 1, 43 (55%) ASA grade 2, and 27 (36%) ASA grade 3. The mean wound length was 21 cm (range, 16–26 cm). The medial parapatellar approach was used in 59 patients (77%) and subvastus approach in 18 patients (18%). Local anaesthesia (0.25% Bupivacaine with 1:1,000,000 adrenalin) was used in 34 patients (44%). The mean tourniquet time was 83 min (range, 38–125 min).

We found a significant association between cessation of oozing and peri-articular local anaesthesia ($P = 0.003$), length of the tourniquet time ($P = 0.03$), and the subvastus approach ($P = 0.01$) as shown in Figures 1 and 2.

There was no association of wound oozing with BMI ($P = 0.27$), ASA grade ($P = 0.1$), DVT prophylaxis ($P = 0.17$) and wound length ($P = 0.07$).

Discussion

Our study shows a significant association between wound ooze and the tourniquet time, subvastus approach and peri-articular local anaesthesia. Persistent wound ooze is responsible for delay in discharge and thus leads to prolonged hospital bed occupancy. Prolonged hospital stay can be frustrating for the patient and family and increases economic burden on healthcare and society.⁵ This is also a cause of concern to both the patient and the surgeon. Persistent wound oozing after joint arthroplasty has been shown to be associated with increase risk of infection.^{5,4} Wound complications may cause deep infection resulting in revision or even amputation.

Wound healing after any incision requires adequate oxygenation. Migration of macrophages and fibroblasts into the wound is secondary to oxygen gradient created between the

capillaries of the wound edges. This means if wound edges are hypoxic then angiogenesis and the migration of macrophages and fibroblasts and consequently the cellular response to the wound healing is inhibited.^{5,6} This means lesser tourniquet time is better for tissue oxygenation and early wound dryness. Reactive hyperaemia and increased fibrinolytic activity occur after tourniquet release leading to excessive bleeding and 10% increase in leg size.^{7,8} If tourniquet is released after wound closure and compression bandaging, the reactive hyperaemia will cause increase in tissue pressure until tamponade occurs.

The subvastus approach offers early advantages over the standard parapatellar arthrotomy. It is believed that it preserves the integrity of the vastus medialis and peripatellar plexus.^{7,8}

Local infiltration analgesia is simple, practical, safe, and effective way for pain management after knee and hip surgery. This leads to early mobility and subsequently better blood flow and oxygenation.⁹

Conclusions

Lower tourniquet time, subvastus approach and use of local anaesthesia lead to early wound dryness after total knee arthroplasty.

References

1. <www.njrcentre.org.uk>.
2. Saleh K, Olson M, Resig S, Bershadsky B, Kuskowski M, Gioe T *et al*. Predictors of wound infection in hip and knee joint replacement: results from a 20 year surveillance program. *J Orthop Res* 2002; **20**: 506–15.
3. Surin VV, Sundholm K, Backman L. Infection after total hip replacement with special reference to a discharge from the wound. *J Bone Joint Surg Br* 1983; **65**: 412–8.
4. Vince KG, Abdeen A. Wound problems in total knee arthroplasty. *Clin Orthop* 2006; **452**: 88–90.
5. Faure BT, Benjamin JB, Lindsey B, Volz RG, Schutte D. Comparison of the subvastus and paramedian surgical approaches in bilateral knee arthroplasty. *J Arthroplasty* 1993; **8**: 511–6.
6. Roysam G. Subvastus approach for total knee arthroplasty. A prospective, randomized, and observer-blinded trial. *J Arthroplasty* 2001; **16**: 454–7.
7. Rama KR, Apsingi S, Poovali S, Jetli A. Timing of tourniquet release in knee arthroplasty. Meta-analysis of randomized, controlled trials. *J Bone Joint Surg Am* 2007; **89**: 699–705.
8. Silver R, de la Garza J, Rang M, Koreska J. Limb swelling after release of a tourniquet. *Clin Orthop* 1986; **206**: 86–9.
9. Parvataneni HK, Shah VP, Howard H, Cole N, Ranawat AS, Ranawat CS. Controlling pain after total hip and knee arthroplasty using a multimodal protocol with local periarticular injections. *J Arthroplasty* 2007; **22**: 33–7.
10. Maderazo EG, Judson S, Pastemark H. Late infections of total joint prosthesis. A review and recommendations for prevention. *Clin Orthop* 1988; **229**: 131–42.
11. Johnson DP. Midline or parapatellar incision for knee arthroplasty. A comparative study of wound viability. *J Bone Joint Surg Br* 1988; **70**: 656–8.

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