



ISSN: 0975-833X

RESEARCH ARTICLE

USE OF PNEUMATIC TOURNIQUET IN TRANSTIBIAL AMPUTATION FOR PERIPHERAL VASCULAR DISEASE : A PROSPECTIVE RANDOMIZED BLINDED CONTROLLED TRIAL

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ARTICLE INFO

Article History:

Received 15th June, 2015
Received in revised form
15th July, 2015
Accepted 20th August, 2015
Published online 16th September, 2015

Key words:

Peripheral arterial disease,
Transtibial amputation,
Tourniquet,
Blood loss,
Randomised controlled trial.

ABSTRACT

Introduction: The traditional view is that tourniquets are contraindicated during amputation surgery with peripheral vascular disease because they might cause damage to arteries in the thigh that are already diseased. Seeing encouraging results from studies done by some researchers we hypothesized that use of a pneumatic tourniquet might improve the outcome following transtibial amputation, without compromising wound healing in a population of elderly patients with peripheral vascular disease.

Materials and methods: Fifty patients were chosen for this study who had non-reconstructible peripheral vascular disease and they were randomised to either tourniquet or no tourniquet (control). Blood loss, fall in haemoglobin, transfusion requirements, wound healing, breakdown and revision were recorded.

Results: The mean intra-operative blood loss was 500 ml (range 300–750) in the control group and the median blood loss was 500ml. The mean blood loss was 252 ml (range 150- 500) in the tourniquet group and the median blood loss was 200 ml ($p < 0.0001$). Mean preoperative haemoglobin was 9.09 gm/dL in the tourniquet group versus 9.15 gm/dL in the non tourniquet control group. The mean postoperative haemoglobin fall was 0.63 gm/dl (6.9%) in the tourniquet group and 1.08 gm/dl (11.08%) in the non- tourniquet group ($p = 0.0001$). The mean postoperative hemoglobin in control group was 7.76 gm/dl and in tourniquet was 8.46 gm/dl .One patient (4%) was transfused with one unit of blood in the tourniquet group. In the non-tourniquet group (control group), however, 10 patients (40%) needed a blood transfusion ($p=0.03$).Two patients (8%) in tourniquet group had wound breakdown which was managed by debridement and secondary closure. Four patients (16%) in control group had wound breakdown. Three patients (12%) in tourniquet group required revision amputation compared with 5 patients (20%) in control group.

Conclusion: Our results show that the use of an tourniquet during below knee transtibial amputation in ischemic limbs significantly reduces intra-operative blood loss, reduces fall in post operative hemoglobin and reduces the need for transfusion without major complications.

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Citation: Rajinder Singh, Abdul Ghani, Aamir Hakak, Sandeep Singh, Bhishan Singh, Kanav Padha and Khalid Muzafar, 2015. "Use of pneumatic tourniquet in Transtibial amputation for peripheral vascular disease: A prospective randomized blinded controlled trial", *International Journal of Current Research*, 7, (9), 20086-20089.

INTRODUCTION

Pneumatic tourniquets have been used for many years in orthopaedics and trauma. They limit blood loss during operative procedures which has many clinical benefits (Guest *et al.*, 2005) and saves cost (Guest *et al.*, 2005) especially in elderly patients who have multiple co morbidities. Use of tourniquets has been shown to reduce blood loss during varicose vein surgery. (Sykes *et al.*, 2000; Robinson *et al.*, 2000) Data examining the use of tourniquet in patients with peripheral arterial disease (PAD) is sparse.

The traditional view is that tourniquets are contraindicated during amputation surgery with peripheral vascular diseases because they might cause damage to arteries in the thigh that are already diseased. Bruce *et al.* (2002) concluded that it is safe to use tourniquet during surgery in patients with impalpable foot pulses or claudication if the femoral pulse is palpable and there is no active ulceration or rest pain. (Bruce *et al.*, 2002) Our subset of patients usually have lower haemoglobin due to nutritional and other causes. Also due to sociological and cultural reasons most relations of patients are not willing to donate blood to the patients. So we are left with gangrenous limbs in anaemic patients. Seeing encouraging results from study done by Wolthuis *et al.* (2006) we

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hypothesised that use of a pneumatic tourniquet might improve the outcome following transtibial amputation, without compromising wound healing in a population of elderly patients with peripheral vascular disease.

MATERIALS AND METHODS

Fifty Patients with severe peripheral vascular disease were chosen for this study. These patients had either rest pain, skin ulceration or gangrene and had been chosen for below knee amputation. Demographic data is given in Table 1. Any patient requiring above knee amputation was not taken in this study. All these patients had ischemic limbs which were not reconstruct able as evidenced by pre operative angiograms. Randomization was performed using a random number table and randomization details were placed in sealed envelopes which were opened in the operating theatre just prior to commencing the operation. Preoperatively all patients were given 1.5 gm cefuroxime intra venously within 30 minutes of starting surgery. Spinal anesthesia was used in all patients. In patients randomized for tourniquet use limb was elevated for about 2 minutes before inflating the tourniquet. Standard Orthopaedic pneumatic tourniquet (non-sterile) was used. It was Inflated to twice the systolic blood pressure. In all patients Burgess type below knee trans-tibial amputation was performed. Following transection of tibia and fibula, the tourniquet was released to see and coagulate any bleeder before suturing of skin flaps. A 14F suction drain was inserted and a non-rigid dressing was used.

Table 1. Demographics

Group	Control	Tourniquet	P value
Number	25	25	Not significant
Age in years (median)	68	67.5	Not significant
Sex (M/F)	16/9	18/7	Not significant
Diabetes	11 (44%)	13(52%)	Not significant

The amount of blood lost intraoperatively was calculated from suction and swabs. Post-operative hemoglobin, transfusion requirements, wound and other complications were recorded. Follow up was performed at 1 and 6 weeks. Post operatively blood was transfused if hemoglobin level fell below 8 gm/dl. Non-parametric data were analyzed using the Mann–Whitney test. Categorical data were compared using the Chisquared test.

RESULTS

Fifty patients were chosen for this study and half of them were randomized for tourniquet use (Table 2).

The patients median age was 67.5 years (range 50-75) in the tourniquet group and 68 years (range, 50-75) in the control group. All patients had end stage peripheral vascular disease which was non reconstruct able or had failed reconstruction. The mean intra-operative blood loss was 500 ml (range 300–750) in the control group. The median blood loss was 500ml. The mean blood loss was 252 ml (range 150- 500) in the tourniquet group. The median blood loss was 200 ml ($p < 0.0001$, Figure 1). Mean preoperative haemoglobin was 9.09 gm/dL in the tourniquet group versus 9.15 gm/dL in the non- tourniquet control group.

Table 2. Results

Group	Control	Tourniquet	P value
Blood loss (median)	500 ml	200 ml	<0.0001
Drop in Haemoglobin (mean)	1.08 gm/dl	0.63 gm/dl	0.0001
Total number of units transfused	10	1	0.03
Wound breakdown	4	2	Not significant
Revision of amputation	5	3	Not significant

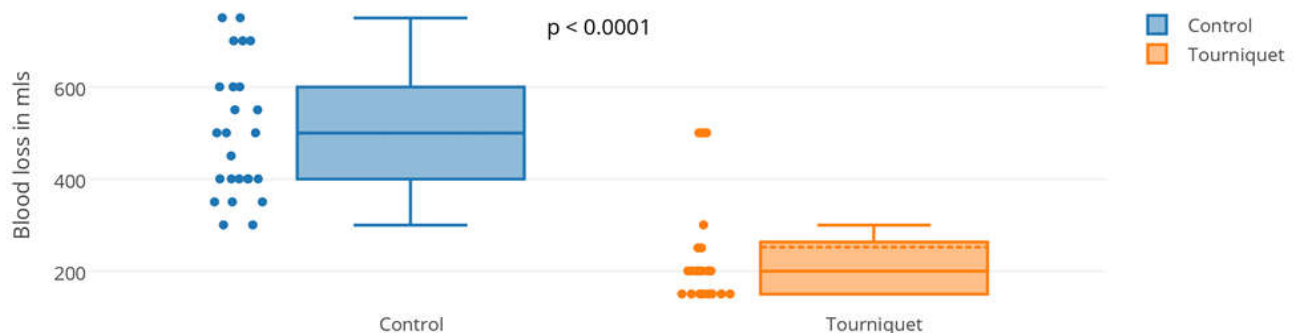


Figure 1. Box and Whisker plots of blood loss (ml) in control and tourniquet groups. Horizontal solid and dashed lines represents group median and mean, respectively. Box represents interquartile range and whiskers represent 5th and 95th percentiles. Dots represent the individual values. * $p < 0.0001$ (Mann–Whitney) control vs tourniquet groups

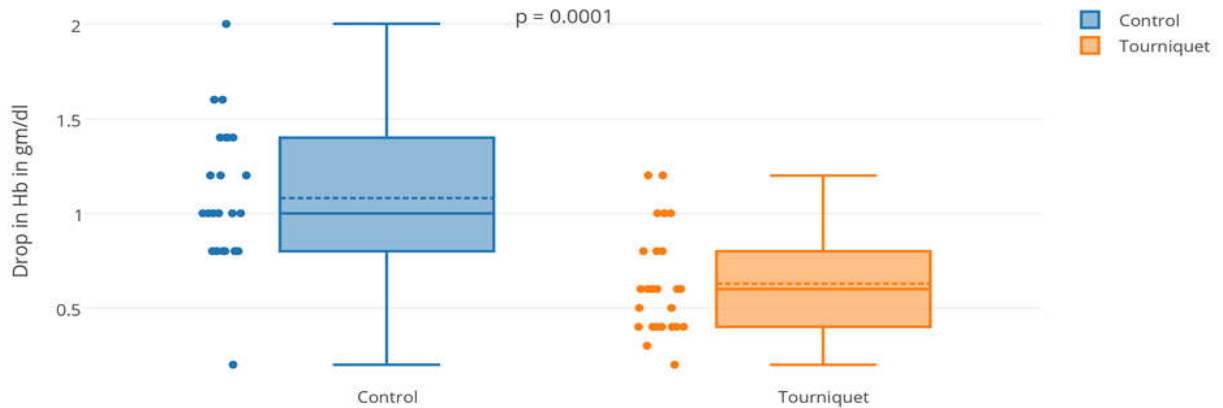


Figure 2. Box and whisker plots of drop in haemoglobin (g/dl) in control and tourniquet groups. Horizontal solid and dashed lines represents group median and mean, respectively. Box represents interquartile range and whiskers represent 5th and 95th percentiles. Dots represent the individual values *p= 0.0001 (Mann Whitney) control vs tourniquet groups

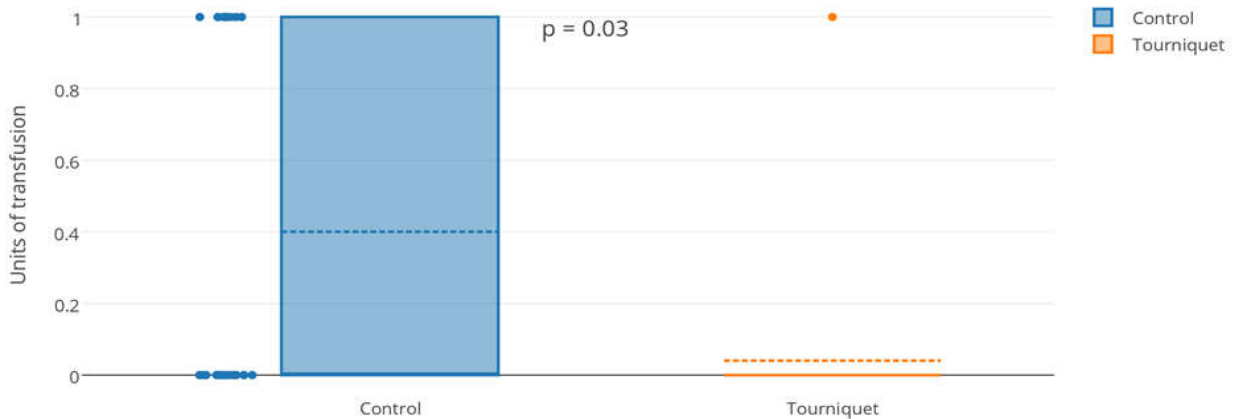


Figure 3. Box and whisker plots of transfusion requirements (units) in control and tourniquet groups. Horizontal solid and dashed lines represents group median and mean, respectively. Box represents interquartile range. Dots represent the individual values. *p= 0.03 (Mann-Whitney) control vs tourniquet groups

The mean postoperative haemoglobin fall was 0.63 gm/dl (6.9%) in the tourniquet group and 1.08 gm/dl (11.08%) in the non-tourniquet group (p =0.0001, Figure 2). the mean postoperative hemoglobin in control group was 7.76 gm/dl and in tourniquet was 8.46 gm/dl

One patient (4%) was transfused with one unit of blood in the tourniquet group. In the non-tourniquet group (control group), however, 10 patients (40%) needed a blood transfusion. In total 11 units of blood were transfused.

The need for transfusion was significantly higher in the non-tourniquet group (p=0.03, Figure 3).

Two patients (8%) in tourniquet group had wound breakdown which was managed by debridement and secondary closure. Four patients (16%) in control group had wound breakdown. Three patients (12%) in tourniquet group required revision amputation compared with 5 patients (20%) in control group.

DISCUSSION

Our results confirm that use of a tourniquet during transtibial amputation significantly reduces intra- operative blood loss. Since loss of blood during surgery is an important predictor of mortality (Law *et al.*, 2004) and our patients have preoperative haemoglobin level on lower side this will lead to clinical benefits. It seems that the previous fears about arterial damage from tourniquets, is unfounded. Our results are broadly similar to those reported by Wolthuis *et al.* (2006) In their study, blood loss was not measured directly, but the inference was made from the drop in haemoglobin concentration and a reduction in transfusion requirements. Like Wolthuis we also observed a lower fall in hemoglobin level and a lower requirement of blood transfusion in tourniquet group. Wolthuis *et al.* observed a beneficial effect on stump revision rate in the tourniquet group. We did not observe a this effect significantly.

In conclusion, our results confirm that the use of an tourniquet during below knee transtibial amputation in ischemic limbs significantly reduces intra-operative blood loss, reduces fall in post operative hemoglobin and reduces the need for transfusion without major complications.

REFERENCES

Bruce ASW, Getty CJM, Beard JD. The effect of the ankle brachial pressure index and the use of a tourniquet upon the outcome of total knee replacement. *J Arthroplasty.*, 2002; 17:312–314.

- Guest JF, Ruiz FJ, Tang R, Wang JY, Changchien CR, Wexner S *et al.* Cost implications of post-surgical morbidity following blood transfusion in cancer patients undergoing elective colorectal resection: an evaluation in the US hospital setting. *CurrMedResOpin.*, 2005; 21(3):447–455.
- Law S, Wong KH, Kwok KF, Chu KM, Wong J. Predictive factors for postoperative pulmonary complications and mortality after esophagectomy for cancer. *Ann Surg.*, 2004; 240(5):791–800.
- Robinson J, Macierewicz J, Beard JD. Using the Boazul cuff to reduce blood loss in varicose vein surgery. *Eur J VascEndovascSurg.*, 2000;20(4):390–393.
- Sykes TC, Brookes P, Hickey NC. A prospective randomised trial of tourniquet in varicose vein surgery. *Ann R CollSurgEngl.*, 2000; 82(4):280–282.
- Tassiopoulos AK, Kwon SS, Labropoulos N, Damani T, Littooy FN, Mansour MA *et al.* Predictors of early discharge following open abdominal aortic aneurysm repair. *Ann VascSurg.*, 2004;18(2):218–222.
- Wolthuis A, Whitehead E, Ridler B, CowanA, Campbell W, Thompson J. Use of a pneumatic tourniquet improves outcome following trans-tibial amputation. *Eur J VascEndovascSurg.*, 2006;31(6):642–645.
