

## Acute Isovolemic Haemodilution in Elective Prostatectomy: An Ethiopian Study

Mekonen Eshete MD, FCS-ECSCA

ArbaMinch Hospital, PO Box 26493, Addis Ababa Ethiopia.

*Correspondence to:* Dr. Mekonen Eshete, Email: [mekonene@yahoo.com](mailto:mekonene@yahoo.com)

**Background:** Major surgical procedures often produce significant haemorrhage that may require transfusion of blood in order to maintain an adequate circulation. This study was aimed at comparing the effect of Acute Isovolemic Haemodilution (AIH) with use of Homologous Blood Transfusion during elective major surgery.

**Methods:** This was a study prospective undertaken in the sub regional hospital at ArbaMinch, Ethiopia over a 15 month period and involved 34 patients admitted for prostatectomy. The patients were divided into two groups, the control group who when indicated received homologous blood, and an AIH group who received some if not all of their own 'freshly drawn blood' which had been taken in the operation room immediately before surgery.

**Results:** There were no differences between the postoperative Haematocrit levels in the two groups, but there were less complications and a shorter hospital stay in the AIH group than in the control group.

**Conclusion:** This relatively small study showed that Acute Isovolemic Haemodilution is a safe technique, which should be used widely in Ethiopia and in other 'developing countries'. AIH avoids the risks of using homologous blood for transfusion.

### Introduction

Major surgical procedures often produce significant haemorrhage that may require transfusion of blood in order to maintain an adequate circulation. Although blood transfusion is undoubtedly life saving in many situations, homologous blood carries the risk of causing transfusion reactions and transmitting infections such as: HIV/AIDS, hepatitis B and C, human T-lymphocyte virus (HTLV 1)<sup>1</sup>. Even with the most rigorous screening, blood can never be completely safe<sup>2</sup>.

At ArbaMinch sub regional hospital it is impossible to screen donated blood for hepatitis B and C viruses (the major cause of post transfusion hepatitis), cytomegalovirus, Epstein Barr virus or the HTLV 1. In addition at ArbaMinch hospital, in common with many hospitals in developing countries<sup>3</sup>, there is always a chronic shortage of blood for transfusion due to a lack of voluntary donors, a high percentage of HIV positive adults (during the study period 14/278 (5%) of the donated blood had to be discarded for this reason), lack of staff trained in donor recruitment, low standards of education and motivation, a general shortage of resources and the low priority accorded to blood transfusion services. Voluntary donation of blood is very rare in most

of rural Ethiopia including ArbaMinch, and therefore the main source of blood for transfusion are from relatives, although a significant amount is bought from commercial blood donors at a cost of 100 Ethiopian Birr that is 11 US dollars per unit in ArbaMinch, and commercial donors are known to be a high-risk group for transmission of infection. It was with such a background that this study was done in order to investigate the use of Acute Isovolemic Haemodilution (AIH) as an alternative to homologous Blood Transfusion in patients undergoing major elective surgery.

### Patients and Methods

This was a prospective study done in ArbaMinch Hospital which is situated 505 km south of Addis Ababa. It is a 172-bed general hospital with 46 beds for surgical patients. This unit is busy with 698 major and 1350 minor operations per year. In the fifteen-months period between 1<sup>st</sup> January 2002 and March 31<sup>st</sup> 2003, 42 patients were admitted for prostatectomy; 34 were considered suitable for inclusion in this study. The exclusion criteria were either a Haematocrit of less than 30%, or clinically detectable cardiovascular, respiratory, hepatic or renal disease. In all eight patients were excluded, three because their Haematocrit was less than 30%, three had chronic renal failure and two had findings consistent with pulmonary tuberculosis. The 34 patients that fulfilled the

inclusion criteria were placed alternately into either an AIH group of 17, or a control group of 17. However two patients had to be placed in the AIH group as they were unable to obtain blood for transfusion. There were no significant differences between the patients in the two groups in regard to general fitness for surgery, age, and their mean preoperative Haematocrit level (Table 1).

On admission every patient underwent routine hematology and urine tests. As all our patients with benign prostatic hypertrophy presented with acute urinary retention their bladders were immediately decompressed by transurethral catheterization. Elective prostatectomy was performed a few days later.

Patients in the control group were asked to provide two blood donors, and this was part of our usual preoperative routine for patients requiring major surgery. From the first five patients in the AIH group 5/17 (29.4%) one unit of blood was taken, and two units were drawn from the remaining 12/17 (70.5%). This was done by a laboratory technician with the patient lying on the operating table immediately before the start of anesthesia using a standard blood pack containing anticoagulant. The anaesthetist then replaced the volume of blood taken with three times the volume of normal saline. All prostatectomies were performed under spinal anaesthesia administered by an experienced nurse anaesthetist. I operated on all of the patients.

Blood loss was estimated by measuring the volume of blood in the suction bottle aided by

visual estimation of the blood lost on the sponges. This 'total' was carefully noted as was the volume of any blood transfused. The Haematocrit level was measured the day after the operation

## Results

Of seventeen patients in the AIH group twelve (70.5%) required transfusion of their own 'freshly drawn' blood. Five out of twelve (41.7%) received one unit, and 7/12 (58.3%) received two units. However **none** of these patients were transfused with homologous blood. Among the control group seven patients 7/17 (41.1%) were each given two units of homologous blood. Postoperatively one patient in the AIH group suffered clot retention, which required repeat cystostomy, clot evacuation and a change of the irrigation system. The hospital stay was longer in the control group with an average of fifteen days as opposed to eleven days in the AIH group. The controls had a higher post operative rate of wound infection 3/17 (17.6%), while in the AIH group this was only 1/17(5.8%). This could be explained by their longer preoperative hospital stay resulting from the necessary search for homologous blood. One of these infections led to a 20 days leak of urine which settled spontaneously. Overall the controls spent an average of four days longer in hospital than the AIH group. There was no mortality in this study, and all the patients were discharged in a satisfactory condition and after having had their catheters removed. Details of the postoperative complications including the one post operative 'leak' are given in the Table 2.

**Table 1.** Age, Preoperative Hct, Postoperative Hct and Duration of Hospital Stay.

	AIH Group	Controls
<b>Age in years</b>		
Range	50-75	50-75
Mean	65	60
<b>Preoperative Haematocrit %</b>		
Range	30-40	30-45
Mean	34	36
<b>Postoperative Haematocrit %</b>		
Range	28-34	22-36
Mean	30	30
<b>Hospital Stay in Days</b>		
Range	9-16	10-25
Mean	12	13

**Table 2.** Postoperative complications

Postoperative Complications	AIH	Controls
Homologous blood transfusion	0	7/17 (41.1%)
Re operation for clot retention	1/17 (5.8%)	0
Wound infection	1/17 (5.8%)	3/17 (17.6 %)
Suprapubic leak	0	1/17 (5.8%)
Mortality	0	0

Overall the controls spent an average of four days longer in hospital than the AIH group. There was no mortality in this study, and all the patients were discharged in a satisfactory condition and after having had their catheters removed. Details of the postoperative complications including the one post operative 'leak' are given in Table 2.

### Discussion

Although the technique of Acute Isovolemic Haemodilution has been known since the 1960s<sup>4</sup>, until now it has probably been under utilized in Ethiopia and other sub-Saharan countries. This study has demonstrated that it is a safe and valuable technique which should be used in situations where medical

facilities are not yet of the highest quality. In particular its use avoids many if not all of the potential risks associated with the use of homologous blood transfusion.

The risk of transfusion related diseases in developing countries is high<sup>5</sup>. The only screening done for blood to be transfused in our hospital was HIV antibody testing. With this test the possibility of transfusing HIV infected blood cannot be excluded. In a study done in Kenya 26 of 1290 (2%) homologous blood transfusion, transmitted HIV infection<sup>5</sup>.

The risk of transfusing hepatitis B and C, malaria and other blood transfusion related diseases is a distinct possibility. Our results also showed that AIH is easy to perform, is safe and effective, and uses only readily available blood bags. It is well accepted by the patients and their families and this has previously been reported in other studies<sup>6</sup>. None of the patients receiving autologous blood had any postoperative complications attributed to the transfusion and this was consistent with findings from other

studies<sup>7</sup>. The postoperative complications of wound infection, suprapubic leak and longer hospital stay (an extra four days) were less than in the control group.

Although blood transfusion was required for some prostatectomy patients in both groups the transfusion rate in the control group 7/17 (41.1%) was consistent with that found in other studies<sup>5</sup>. It was interesting to note that while more than 12/17 (70%) of the AIH group were transfused with their own blood, ten units of their freshly drawn blood were not used and this was saved for further use by the blood bank.

### Conclusion

This study demonstrated that Acute Isovolemic Haemodilution is a safe, inexpensive and readily available alternative to homologous blood transfusion for patients undergoing major surgery. Its use should be encouraged where blood transfusion is dependent on 'family donation' or on commercial donors whose blood is associated with a greater risk of disease transmission such as HIV, hepatitis B and C, bacterial infection and malaria.

### Acknowledgement

I wish to thank Dr.E. Anberber, Mr.Feissa W/Cherkos, Mr. A. Nigatu, and Mr.T. Girmaye, Dr. D. Jirane and the Theatre and surgical ward staffs for their support. Professor Geoffrey Walker FRCS gave assistance with the manuscript.

### References

1. Mollison PL, Engelfriet CP, Contreras M (eds). Some Unfavorable Effects of Blood transfusion in clinical medicine, 10<sup>th</sup> ed.1988.

2. Ward JW, Holmberg SD, Allen JR, et al. Transmission of Human immunodeficiency virus (HIV) by blood transfusion screened as negative for HIV antibody. *N Engl J Med* 1988; 218:473-8.
3. Beal RW, Transfusion science and practice in developing countries; "...a high frequency of empty shelves..."*Edit Transf* 1993; 33(4): 276-8.
4. Hardesty RL, Bayer WL, Bahnson HT. A technique for the use of autologous fresh blood during open - heart surgery. *J Thorac Cardiovasc Surg* 1968; 56: 683-8.
5. Moore A, Guillermo Herrera Jack Nyamongo et al. Estimated risk of HIV transmission by blood transfusion in Kenya. *Lancet* 2001 August 25; Vol 358.
6. Matot I, Scheinin O, Jurim O, Eid A, effectiveness of acute normovolemic Hemodilution to minimize allogenic blood transfusion in major Liver resections. *Anesthesiology* 2002; 97: 794-800.
7. Manda W, Duffy G: Experience of autologous blood transfusion at a district general hospital in Zambia. *Tropical Doctor*. 1994; 24: 108-111.