ORIGINAL RESEARCH PAPER
Volume-8 | Issue-11 | November - 2019 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

IS ICG FLORESCENCE GUIDED EXCISION THE MISSING LINK IN PERFECTING BURN WOUND EXCISION AND GRAFTING?

Plastic Surgery

Dr Ram Mohan* Assistant Professor, Dept of Burns & Plastic Surgery Dr.RML Hospital,Delhi *Corresponding Author

Dr Manoj Jha Professor, Dept of Burns & Plastic Surgery Dr.RML Hospital,Delhi

Dr Naveen Kumar Senior Resident, Dept of Burns & Plastic Surgery Dr.RML Hospital,Delhi

Dr Vinay Tiwari Professor, Dept of Burns & Plastic Surgery Dr.RML Hospital,Delhi

ABSTRACT

Introduction: Surgical management of burn wounds result in a considerable amount of blood loss. This study was conducted to find the effectiveness of ICG spycam in reducing blood loss.

Materials and methods: A pilot study was conducted to ascertain usefulness of ICG spycam in burn surgery. After burn wound excision ICG was infused and vascularity of the wound bed was assessed using spycam. After ensuring adequate excision and good vascularity of wound bed with the help of spycam, grafting of wound was done. The blood loss during the surgery was calculated and compared with previous studies.

Results: We achieved a 27% reduction of blood loss per percentage area. No complications were encountered in all patients.

KEYWORDS

ICG, Spycam, blood loss, burn wound excision

INTRODUCTION:

Several studies have shown that early excision and grafting is beneficial to the patient in numerous aspects. Research by Munster, Smith, Meek, Sharkey (1994) shows early excision and grafting improves the survival rate of the patient. It also reduces the duration of hospital stay, reduces the cost of treatment (Engrav, Heimbach, Reus, Harnar and Marvin.,1983) and lower incidence of sepsis (Heimbach.,1982). Early excision and grafting is being followed at many centres throughout the world. Regrettably surgical management results in considerable blood loss intra operatively. Studies by Moran, O'Reilly, Furman and Munster(1988) and Budney, Regan, Roberts(1993) estimated blood loss between 196 to 296 ml for each percent of body surface area excised and grafted. Robert Cartotto, Melinda and Massey(2000) further minimized this blood loss to 123 to 106 ml per percent of body surface area. However it is still an substantial amount. Controlling blood loss is of paramount importance in children, elderly, anaemic patients and people with bleeding disorder.

Indocyanine green(ICG) is water soluble, tricarbocyanine dye. After intravenous injection it is efficiently removed from the blood by the liver and excreted into the bile. It is widely used for measuring cardiac output, as a liver function test, and for fluorescence angiography of the choroidea. After intravenous injection it binds almost completely to large plasma proteins, allowing complete intravascular localization of the dye. Flower and Hochheimer used ICG to evaluate perfusion in 1976. Since then numerous studies have established the usefulness of this method to evaluate perfusion. In Plastic Surgery this technique is primarily used for evaluating perfusion of the flaps especially in microsurgical reconstruction. Some centres use it to asses depth of the burn wound. Perhaps this is the first study to evaluate its usefulness in limiting blood loss in excision surgery and grafting.

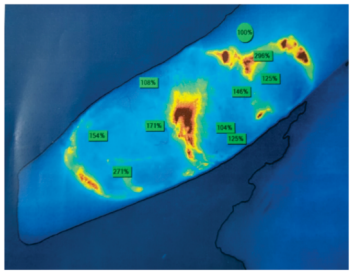
The new technology spycams allows one to compare the percentage of blood flow in relation to the normal skin in realtime. Perfusion images showing different zones of perfusion with levels of differential perfusion to unburnt skin reference level of 100% can be seen and operative decisions taken accordingly.

MATERIALS AND METHODS:

A study was conducted at our department to find out the effectiveness of spycam technology in controlling blood loss and overall result. At our department we used the near infra red fluorescencespycam (NOVADAQ) during early excision and grafting procedures.

The study was conducted on six patients, with varying age groups and both sexes,and varying percentage of burn injuries(within 40% TBSA). All the surgeries were done under general anesthesia. After cleaning and draping tangential excision was done. Once excision was completed ICG was administered and vascularity was examined using spycam. The relative vascularity of each area is ascertained. Spycam shows relative perfusion of multiple areas with respect to normal tissue as 100%(Figure 1).

Figure 1: Spycam image showing different areas of vascularity



An arbitrary minimal value of 80% vascularity of the normal area is taken as a cut off point. If any area is found to be under perfused tangential excision is done again in that particular area only. Once satisfactory vascularity is established the excised wound is covered with coarse gauze dipped in 1:100,000 epinephrine.after a few minutes excised wound is inspected for any major bleeders and hemostasis is achieved. The donor area is infiltrated subcutaneously with 1:100,000 ephinepnrine in normal saline. Skin graft is harvested using a power dermatome. As soon as the graft is harvested the donor area is covered with coarse gauze soaked in 1:100,000 epinephrine. After a few minutes donor area is examined for any major bleeders. After securing hemostasis firm dressing is done over donor area. Graft take is examined after 5 days. Second look dressing was done at 7thpost operative day. The parameters recorded were age, sex, weight of the patient, percentage of burn, pre operative hemoglobin and post operative hemoglobin. Blood loss is calculated using formula of Budney et al.,(1993) and Judkins (1996) modified by Gross. The duration of hospital stay was also noted.[TABLE 1]

Table 1: Patient Profile And Course Of Hospital Stay

S.no	Age	Sex	% Burn TBSA	Blood loss per % TBSA (ml)	Graft take (%)	Discharged on Day	Post op transfusion
1	22	M	35	82	100	6	Nil
2	55	F	20	87	100	8	Nil
3	06	M	25	78	100	6	Nil
4	37	F	38	88	100	8	Nil
5	18	M	22	86	100	7	Nil
6	04	F	24	80	100	8	Nil

DISCUSSION

A wide variety of measures are used to reduce the intra operative blood loss. Some of these are subcutaneous infiltration of epinephrine both at

the donor and excised wound, application of topical vasopressors at the donor sites and/or excised wounds, administration of systemic vasopressors, controlled hypotension during surgery, using tourniquets while excising upper and lower limb wounds and laser excision.

ICG fluoresencse was shown to be effective in assessing burn depth by Sheridan, Schomaker, Lucchina, Hurley, Yin ,Tompkins(1995)and Still, Law, Klavuhn, Island, Holtz (2001). However ICG fluorescence technique was not previously used to reduce blood loss and to improve graft survival.

The estimated blood loss was calculated using the modified formula of Budney and Judkins. The previously followed formula was CBL = EBV X [(Hb pre – Hb post)/Hb pre] + Tx, where CBL is calculated blood loss, EBV is estimated blood loss, Hb pre is pre-operative Hemoglobin, Hb post is post operative Hemoglobin after 24 hours and Tx is the total amount of blood transfusion received intra operatively and post operatively in mllilitres. The disadvantage of this formula is that it calculates blood loss assuming that decrease of hemoglobin is directly proportional to the volume of blood lost with the initial hemoglobin concentration. This formula would therefore over estimate the blood loss. However there is a intraoperative dilution of blood due to the intra venous fluids administered during the surgery as well as post operatively. As the surgery progresses there is progressive dilution of hemoglobin. To correct this disparity Gross modified the formula as follows : CBL = EBV X[(Hb pre – Hb post) / Hbav] + Tx where Hbav is the average of post operative and pre operative hemoglobin. 70 ml per kg is used for the calculation of EBV.

One drawback of the study is the high cost involved. Apart from the initial investment needed to procure the investments, the cost of the ICG dye to be used per patient should be also taken into consideration. Limited availability of the ICG dye is also a hindrance.

The authors intended this study to suggest the best possible method to reduce blood loss during surgery. The blood conserved with this method may appear less, but, it is invaluable in cases of children, elderly, delayed grafting and people with bleeding disorders. The graft take is satisfactory in our case series. Since the graft bed was well vascularized theoretically the graft take should be better.

RESULTS:

The reported blood loss even with all conservation measures is 123 to 106 ml per percentage of surface area of burn(Robert et al.,2000).In our study the mean blood loss per percentage of burn is 83.5 ml a 27 % reduction in blood loss. We did not encounter any graft loss in our series. All the patients were discharged within 10 days of the surgery.

The probable reason for the reduced blood loss is the accurate estimation of vascularity at an early stage of the tangential excision. The end point of tangential excision is usually assessed visually by the presence of punctate bleeding and identification of healthy tissue.

In our series of six patients of different ages, sex and burned surface areas, we conclude that ICG fluorescence coupled with near infra red camera is effective in reducing the blood loss during surgery and improves the overall effectiveness of the graft survival.

REFERENCES :

1. Munster AM, Smith D, Meek M, Sharkey P.(1994)The effect of earlysurgical intervention on mortality and cost-effectiveness in burn care1978–91. Burns,20,61– 64
2. Engrav LH, Heimbach DM, Reus JL, Harnar TJ, Marvin JA.(1983) Early excisionand grafting vs. nonoperative treatment of burns of indeterminate depth: a randomized prospective study. J Trauma,23,1001–1004
3. Heimbach DM.(1982). Early surgical excision vs. conventional therapy in patients with 20–40% burns. Am J Surg,144,76 –79.
4. Moran KT, O'Reilly TJ, Furman W, Munster AM.(1988). A new algorithm for calculation of blood loss in excisional burn surgery. Am Surg,54,207–208
5. Budney PG, Regan PJ, Roberts AHN.(1993) The estimation of blood loss during burns surgery. Burns,19,134–137
6. Robert Cartotto, Melinda A. Musgrave,MasseyBeveridge et all(2000).Minimizing Blood Loss in Burn Surgery.J Trauma,49,1034 –1039
7. Judkins KC. Anesthesia. In: Settle JAD, ed.(1996) Principles and Practice of Burns Management. New York: Churchill Livingstone,314
8. Sheridan RL, Schomaker KT, Lucchina LC, Hurley J, Yin LM,Tompkins RG, et al.(1995) Burn depth estimation by use of indocyanine green fluorescence: Initial human trial. J Burn Care Rehabil,16,602-4.
9. Still JM, Law EJ, Klavuhn KG, Island TC, Holtz JZ.(2001) Diagnosis of burn depth using laser-induced indocyanine green fluorescence: A preliminary clinical trial. Burns,27, 364-71