



The PEAK Plasma Blade may Reduce Postoperative Analgesic Medication use in Breast Cancer Surgery

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#Equal contribution

Abstract

Objective: Postoperative wound pain is one of common problems in modern breast surgery. With a lower energy spread, Plasma Blade potentially induces less tissue damage. This study was aimed to investigate effects of Plasma Blade on postoperative wound pain.

Patients and Methods: The records of patients who underwent breast surgery by a single surgeon from August 2012 to December 2012 were retrospectively collected. There were 13 and 24 patients in groups Plasma Blade and traditional electrocautery; respectively. Postoperative wound pain was evaluated with the Visual Analogue Scale (VAS).

Results: Varieties of VAS pain scores in group electrocautery were greater than that in group Plasma Blade; the declining trend of pain score in group Plasma Blade was also greater than that in group electrocautery. Furthermore, there was a significant decrease in analgesic medication use in group Plasma Blade.

Conclusion: The Plasma Blade showed benefit in the reduction of postoperative pain and analgesic medication use compared to traditional electro surgery.

Keywords: Mastectomy; Pain management; Postoperative; Surgical instruments

Introduction

The main goal in breast cancer surgery traditionally has been to achieve focal clearance and prevent local recurrence. However, with the increased interest in pursuing a better cosmetic outcome, the best way to achieve good wound healing has become a more and more important issue. Traditional electrosurgical devices are in dissection and hemostasis. A significant thermal injury to adjacent tissue is sometimes inevitable, and this may increase wound inflammation [1,2], delay wound healing and result in a dissatisfying aesthetic outcome and wound pain [3,4].

The PEAK Plasma Blade is a novel surgical device that uses very brief, high-frequency pulses of radiofrequency energy [5] to induce electrical plasma along the edge of a thin (12.5 μm), 99.5% insulated electrode [6,7]. The Plasma Blade uses less total energy at a significantly lower temperature than the traditional electrosurgical device (40-170°C vs. 200-350°C) [8]. This property may theoretically lead to the advantages of less smoke during operation, less postoperative pain, and better wound healing. Plasma Blade incisions had the same wound strength as scalpel incisions, and less thermal damage than traditional electro surgery, in both animal [9] and human models [10]. Fine's case control study showed the Plasma Blade may help reduce the risk of skin flap necrosis after mastectomy and exhibited a better cosmetic outcome [11]. This study aimed to evaluate the advantages of the Plasma Blade compared to traditional electro surgery relative to postoperative wound pain.

Patients and Methods

From August 2012 to December 2012, patients who received breast cancer surgery by a single

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Table 1: Analgesic medications used on operation day and postoperative day 1 with different operative methods in the groups Plasma Blade and traditional electrocautery.

Operative methods		The proportion of patients using analgesic medications (%)	
		Operation day	Postoperative day 1
MRM	Plasma Blade (n=2)	100 (2/2)	0 (0/2)
	Traditional electrocautery (n=6)	100 (6/6)	100 (6/6)
SM+SLNB	Plasma Blade (n=2)	100 (2/2)	0 (0/2)
	Traditional electrocautery (n=2)	100 (2/2)	100 (2/2)
BCS+SLNB	Plasma Blade (n=7)	85.7 (6/7)	14.3 (1/7)
	Traditional electrocautery (n=12)	100 (12/12)	91.7 (11/12)
BCS+ALND	Plasma Blade (n=1)	0 (0/1)	0 (0/1)
	Traditional electrocautery (n=2)	100 (2/2)	100 (2/2)
NSM+ALND	Plasma Blade	-	-
	Traditional electrocautery (n=2)	100 (2/2)	100 (2/2)
Guide wire localization partial mastectomy	Plasma Blade (n=1)	0 (0/1)	0 (0/1)
	Traditional electrocautery	-	-
Total	Plasma Blade (n=13)	76.9 (10/13)	7.7 (1/13)
	Traditional electrocautery (n=24)	100 (24/24)	95.8 (23/24)

MRM: Modified Radical Mastectomy; SM: Skin-sparing Mastectomy; SLNB: Sentinel Lymph Node Biopsy; BCS: Breast-conserving Surgery; ALND: Axillary Lymph Nodes Dissection; NSM: Nipple-sparing Mastectomy

surgeon at the Changhua Christian Hospital (Changhua, Taiwan) were enrolled. The PEAK Plasma Blade 4.0 Tissue Dissection Device (PS200-040, Medtronic Advanced Energy LLC, and United States) was used with 13 patients, and electro surgery with 24. Using the PEAK Plasma Blade for surgery was decided by the patient's own due to the differences in health insurance coverage.

Their medical records were retrospectively reviewed. The operative method, blood loss, drainage amount, postoperative wound pain and analgesic agent usage were documented and compared between the two groups.

As general breast surgery procedures, the patient was prepared for operation after anesthesia. The Plasma Blade was used for skin incision, subcutaneous dissection and tumor excision, with the same setting commonly used in breast surgery.

Postoperative pain was measured and documented using the Visual Analogue Scale (VAS) during the operative day, and on postoperative day 1 and day 2, because most of the patients were discharged on day 2. In our clinical practice, oral non-steroidal anti-inflammatory drug (NSAID) is routinely used in breast cancer surgery patients since postoperative day 0. Acetaminophen (500 mg) was routinely used after operation for pain relief. If the patient still suffered from pain, we would give her a single dose of NSAID after assessment. The extra analgesic medications used during the operative day and on postoperative day 1 were recorded. The operative methods for both groups are listed in Table 1.

Data analysis had been performed with SPSS (Statistical Package for Social Science) 16.0 version.

Results

The varieties of VAS pain scores on day 0 and day 1 postoperatively were greater when using electrocautery than when using the Plasma Blade (Figure 1). The downgrade trend in the pain score with the Plasma Blade was also greater than that when using electrocautery. However, there is no statistical significance given for difference

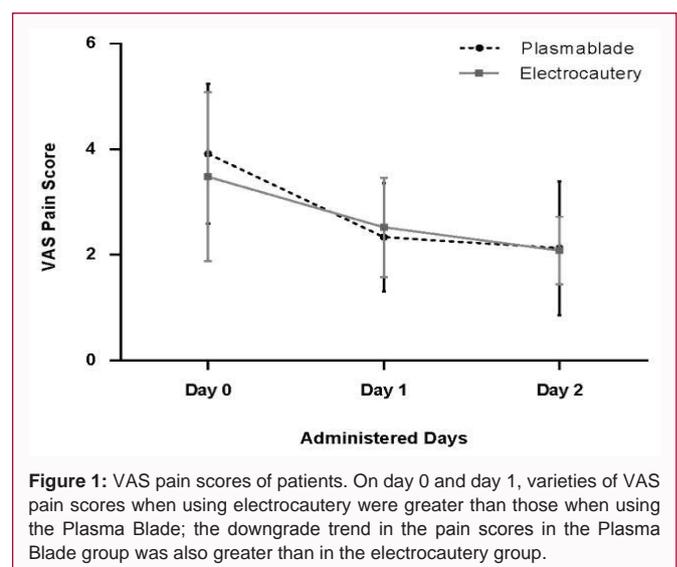


Figure 1: VAS pain scores of patients. On day 0 and day 1, varieties of VAS pain scores when using electrocautery were greater than those when using the Plasma Blade; the downgrade trend in the pain scores in the Plasma Blade group was also greater than in the electrocautery group.

between varieties of VAS pain score in day 0, day 1, and day 2 ($p=0.23$, 0.28 and 0.46).

Eighteen patients received breast-conserving surgery with sentinel lymph node biopsy. During the operative day, most of the patients in both groups needed an analgesic agent. However, during postoperative day 1, none of the patients in the Plasma Blade group needed analgesic agents, although most of the patients in the electro surgery group still did. Similar results were noted in other subgroups. In total, only one of 13 patients in the Plasma Blade group needed analgesic medication during postoperative day 1, and 23 of 24 patients in the electro surgery group did ($p < 0.01$) (Table 1). Besides, the blood loss and drainage amount documented in both group showed no statistic difference.

Discussion

Due to the shortened duty cycle and the electrode with a small

exposed area, the PEAK Plasma Blade consumes much less total energy and has a much lower average power output than conventional electro surgery to achieve an equivalent rate of tissue cutting, and this may reduce collateral thermal damage [6,7]. This characteristic revealed its benefit in cosmetic terms, with less skin or flap necrosis during nipple-sparing or skin-sparing mastectomy [11-13], which contributed to better wound healing and a more aesthetic outcome.

The downgrade of the pain score with the Plasma Blade has tended to be greater than when using electrocautery. However, there is no statistical significance in two groups. An unpublished trial (ClinicalTrials.gov Identifier: NCT00986453) using VAS pain score as primary end point but failed to show any significant difference. We faced the same problem, and looked forward to another parameter to show a benefit of Plasma Blade. The need of analgesia may indicate higher degree of pain. Less demand of postoperative analgesic medication in Plasma Blade group may imply less postoperative pain. Fortunately, there was a significant difference between the two groups in postoperative analgesic agent usage. On day 0 postoperatively, all the patients in the electrosurgical group needed analgesic medications, and most of the patients in the Plasma Blade group. On day 1 postoperatively, this trend of analgesic medication usage was becoming more obvious (Table 1). One possible explanation could be the lesser amount of thermal injury depth, scarring, and inflammation produced by the Plasma Blade. Loh et al. [9] reported fewer CD3+ lymphocytes and macrophages in the wounds produced by the Plasma Blade than by electro surgery [9]. With less energy delivery, the Plasma Blade could produce less thermal injury, which might lead to a less active inflammatory process. This low energy delivery device also showed its benefit in the flap survival of bilateral skin-sparing mastectomy reported by Rusby and Stolier [12,13]. Also, Plasma Blade showed shorten of drainage duration time and amount without increase operation duration or the amount of blood loss compared to electrocautery in Dogan's study [14]. Electrocautery applications in surgical operations produce smoke, which is due to the incomplete combustion of electrical current in the tissues and blood vessels that contains significant unknown chemicals and biological forms; the potential hazards and cancer risk, should not be ignored [15]. The lesser amount of evasive odorous smoke produced by the Power Blade may have potential advantages for surgical staff occupational health.

The limitations of this study include that all of the cases in the two groups were selected retrospectively during the same period and in a single institution, and the same surgeon performed all operations. Since this was not a randomized controlled study, there could be some bias in case selection and patient characteristics. Furthermore, neither surgeon nor patient was blinded, which may influence objective pain scores and usage of analgesic agents.

Once a patient knew that a novel device with lower energy delivery was used during the operation, an anticipation of less pain and better comfort could be expected, which might reduce the demand for analgesic medication. In addition, the surgeon was not blinded. There could have been more surgical precision and delicate dissection in the Plasma Blade group, because people tend to pay more attention to a new or unfamiliar device. Last, several kinds of surgical procedures

were included, and the case number of each was limited. Further larger scale, randomized studies with controlled characteristics may provide more significant and reliable data about the benefit of the Plasma Blade in breast surgery.

Conclusion

PEAK Plasma Blade is a novel device that showed benefit in the reduction of postoperative pain and analgesic medication use compared to traditional electro surgery.

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