Original Article

Use of Hemorrhoid Energy Treatment Combined with Vessel Sealer for Grade III and IV Hemorrhoidectomy

Chung-Chia Ke[1]
Chang-Chung Lu[2]
[1]*Department of Surgery,*
[2]*Department of Colo-rectal Surgery, Kaohsiung Chung Gung Memorial Hospital, Kaohsiung, Taiwan*

Key Words
Hemorrhoidectomy;
HET;
Erbe;
Postoperative bleeding

Purpose. We evaluated whether the use of hemorrhoid energy treatment (HET) combined with the Erbe energy device for hemorrhoidectomy was associated with reduced pain and lower bleeding rates.
Methods. This single-center retrospective study included 59 patients with grade III or IV hemorrhoids. All patients underwent hemorrhoidectomy with the Erbe device or with the Erbe device plus hemorrhoid energy treatment (HET). Patients' clinical characteristics and prognosis were analyzed.
Results. In patients using the Erbe device, the bleeding rate was 24% (n = 6/25), which was higher than that of patients using the Erbe device combined with HET (11.8%; n = 4/34), but without statistical significance (p = 0.93). In addition, there was no significant difference in postoperative side effects, including urine retention (p = 1.0), anal stricture (p = 1), or number of days during which softeners were used (p = 0.59). Only one case of urine retention occurred in the Erbe combined with HET group, which improved after one intermittent catheterization procedure in hospital care. One patient in the Erbe device group experienced anal stricture and was readmitted to our hospital 1 month post surgery. High postoperative pain (visual analog scale > 3 points) occurred in 32.4% of patients in the Erbe combined with HET group as compared with 20% of patients using the Erbe device alone (p = 0.44).
Conclusions. Among patients with grade III or IV hemorrhoids, HET combined with the Erbe system hemorrhoidectomy may provide a new technique in hemorrhoidectomy and decrease the bleeding rate after operation.
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For symptomatic patients, several non-surgical outpatient office-based treatments are currently available including rubber band ligation, infrared coagulation, sclerotherapy, bipolar diathermy, laser photocoagulation, and sclerotherapy.[1] The goal of non-surgical treatment is to decrease vascularity, reduce redundant tissue, and increase hemorrhoidal rectal wall fixation to minimize prolapse.[3]

Symptomatic grade III and grade IV hemorrhoid treated with energy device (Erbe BiClamp®201T DE) which routine apply in the clinical patients. However, the grade III or grade IV hemorrhoid always existed with grade I or grade II hemorrhoid which treated with energy device or electric burn at the same time in the operation. In our clinical experience, the more hemorrhoidectomy we approach and the bleeding rate and

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Correspondence to: Dr. Chang-Chung Lu, Division of Colorectal Surgery, Department of Surgery, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University College of Medicine, Kaohsiung 83301, Taiwan. Tel: 886-7-731-7123; Fax: 886-7-731-8762.

post operative bleeding attacked frequently compared to those treated single hemorrhoidectomy.[2]

The hemorrhoid energy treatment (HET Bipolar System HET Systems, LLC, Oxford, CT, USA) is designed for ligation of the superior hemorrhoidal blood supply by using an incorporated tissue clamp and bipolar energy.

In this study, we selected 59 patients to compared the efficacy about postoperative bleeding, pain and other side effects of HET Bipolar System combined with energy device assisted hemorrhoidectomy patients who belong to grade III and grade IV.

Material and Method

This was an IRB-approved retrospective study (Kaohsiung Chang Gung Memorial Hospital, Study #202200762B0) conducted at our tertiary care referral center from March 2021 to November 2021. Adult patients (≥ 18 years old) with Grade III or Grade IV hemorrhoid scheduled for outpatient treatment with the HET system and Erbe system during the study period were eligible for inclusion. All enrolled 59 patients were contacted in the following OPD visit and recorded the bleeding events, softers used, and the postoperative pain score recorded in hospital course. There were 34 patients accepted Erbe combined with HET hemorrhoidectomy and the rest patients in this study accepted Erbe hemorrhoidectomy. The method of operation (HET + Erbe) was described in medtronic anoscope technique and standard procedure.

In this study, these patients accepted the visual analogue scale (VAS) Q4H after operation (hemorrhoidectomy with Erbe or Erbe combined with HET) by nursing care and these people used softners (sennoside, conslife, Magnesium Oxide 250 mg Tablet) in medical recorded was analyzed for the period of medicine used after operation.

A concurrent chart review was performed to collect patient demographics, procedural and clinical data. Statistical analyses were performed with SPSS software (IBM, SPSS Version 25.0; Armonk, NY, United States). In the study, we used univariate analysis (Chi-square test) in comparison of age, gender and grade of hemorrhoid and we used multivariate analysis (pair-t test) to determine the outcome (pain, postoperative bleeding, return ER risk, anal stricture, and urine retension) and side effect of hemorrhoidectomy with Erbe or Erbe combined with HET.

HET Techniques

The HET Bipolar System is a modified anoscope, with incorporated bipolar clamp and tissue temperature monitor (Fig. 1). HET was utilized with a commercially available electrosurgical generator (ERBE; Marietta, GA, United States). In this study, we used the Medtronic anoscopy technique includes insertion of the tip to superior hemorrhoidal area and grasped with bipolar forceps. After we confirmed the tissue was fixed, bipolar current was applied with using the recommended electrosurgical generator coagulation settings.

The energy device (Erbe BiClamp®201T DE) Technique

Our energy device assisted hemorrhoidectomy with Erbe system included the left side or right decubitus and we used forceps to separate the hemorrhoid tissue from sphincter level (Fig. 2). After confirming that the tissue grasped is sufficient (sphincter free from the hemorrhoid tissue), bipolar current was applied with using the recommended electrosurgical generator (VIO® 300 D DE) coagulation settings (Fig. 2).

Fig. 1. Hemorrhoid energy treatment clump of the proximal vein plexus of the hemorrhoid.

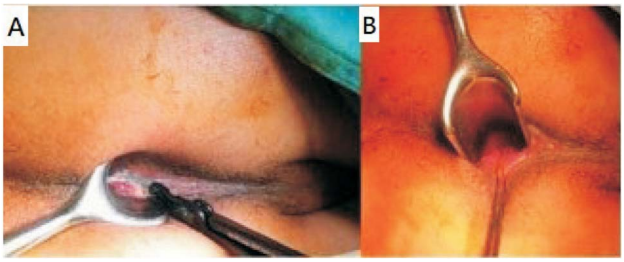

Fig. 2. (A) Erbe system-assisted hemorrhoidectomy. (B) Forceps-assisted free hemorrhoid from the sphincter level.

Medtronic anoscopy technique

This technique includes insertion of the bipolar forceps under LED light provided at the top of the forceps and performing the procedure under direct vision. The superior hemorrhoidal plexus area, approximately 1 cm above the proximal extent of the internal hemorrhoid, was grasped with the bipolar forceps. After confirming that the tissue grasped is sufficient (by means of same level approximation of three red lines on bipolar forceps handle), bipolar current was applied with using the recommended electrosurgical generator coagulation settings (Fig. 3).[5]

Standard procedure

In our study, we apply the Erbe BiClamp®201T DE toward to the third or fourth grade hemorrhoid tissue as before, the HET also applied on the proximal vein branch of grade III or IV hemorrhoid which treated with Erbe on distal prolapsed hemorrhoid. We recorded the 24 hours pain score in each 4 hours during the hospital course. The bleeding problems was recorded in the electrical chart after the visited of patient in our hospital whether in our emergency room or scheduled clinics.

Result

A total 59 patients with grade III to IV hemorrhoid who accepted hemorrhoidectomy with Erbe system only in 25 persons (42.4%) and accepted hemorrhoidectomy with Erbe system combined with HET in 34 persons (57.6%) were included in this study (Table 1). The median age of Erbe system was 45 (range: 17-87) years and the median age of Erbe system + HET was 46 (range: 33-76) years. Seventeen people (68%) had grade III hemorrhoid.

Besides, we used Chi-Square about the data of age (Erbe group mean age: 48.2 and Erbe combined with HET mean age: 46.7, $p = 0.71$), gender ($p = 0.41$), and grade of hemorrhoid ($p = 0.11$) between Erbe and Erbe combined with HET hemorrhoidectomy showed there was no statistics difference in the two groups.

All these 59 people were separated in 2 team as VAS score ≤ 3, and VAS > 3 points account for five (20%) (n = 5/25) man in people who used Erbe system only and eleven (32.4%) (n = 11/34) people used Erbe system and HET device for hemorrhoidectomy at the same time.

Our standard procedure of HET combined with Erbe system or Erbe system applied in 34 and 25 patients in each group. All of these people visited our scheduled clinics or visited to our emergency room recorded at 3 months post-procedure to complete a questionnaire regarding complication or improvement of bleeding symptoms, and compliance with softener use. The pain score and urine retension was also recorded.

The bleeding rate of people used Erbe system was 24% (n = 6/25) and used Erbe system combined with HET system was 11.8% (n = 4/34). We found the rate of bleeding events in the group of Erbe combined with HET had obvious lower than Erbe system group. However, the statistics showed no obvious difference in the comparison (OR = 1.06; 95% CI 0.26-4.32, $p = 0.93$) (Table 2). Besides, the side effect after opera-

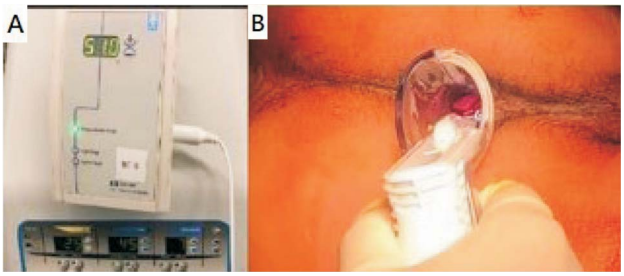

Fig. 3. (A) We set 51 °C as the recommended coagulation temperature. (B) The forceps of HET treated on the proximal site above hemorrhoid and the device worked about 6-8 times.

Table 1. Demographic characteristics of the patients

	Hemorrhoidectomy with Erbe Number of participants (%) (N = 25)	Hemorrhoidectomy with Erbe + HET Number of participants (%) (N = 34)	Univariate analysis *p* value
Median age	45	46	0.71[a]
Female, n (%)	12 (48)	20 (58.8)	0.41[a]
Grade of hemorrhoids (%)			0.11[a]
Grade III	17 (68)	29 (85.3)	
Grade IV	8 (32)	5 (14.7)	
Used of softners			0.50[a]
< 14 days	14 (56)	22 (64.7)	
Urine retension			1.0[a]
Yes	0 (0)	1 (2.9)	
Post operative bleeding			0.967[a]
Yes	6 (24)	4 (11.8)	
Pain score			0.292[a]
> 3 points	5 (20)	11 (32.4)	
≤ 3 points	20 (80)	23 (67.6)	

[a] Chi-square test (χ^2); [a] *p* value < 0.005 denotes a statistically signifcant result. Erbe: Energy device, a reused vessel sealer; HET: hemorrhoid energy treatment. Pain score: The visual analog scale (VAS).

Table 2. Comparison of hemorrhoidectomy between Erbe and Erbe + HET system

Categories	Yes N (%)	No N (%)	Multivariate analysis OR (95% CI), *p* value
Post operative bleeding			1.06 (0.26-4.32), 0.93[a]
Erbe system (25)	6 (24)	19 (76)	
Erbe system + HET system (34)	4 (11.8)	30 (88.2)	
Urine retension			1.0[b]
Erbe system (25)	0 (0)	25 (100)	
Erbe system + HET system (34)	1 (2.9)	33 (97.1)	
Anal stricture			1.0[b]
Erbe system (25)	1 (4)	24 (96)	
Erbe system + HET system (34)	0 (0)	34 (100)	

[a] Multivariate analysis; *p* value < 0.005 denotes a statistically signifcant result. [b] Chi-square test (χ^2); *p* value < 0.005 denotes a statistically signifcant result.

Erbe system: Constant Voltage Regulation with Power Dosing automatically delivers lowest effective adjusted power output in all modes, including both CUT and COAG HET system: The treatment targets the area above the dentate line and its low treatment temperature minimizes collateral tissue damage.

tion, like urine retension ($p = 1$), anal stricture ($p = 1$) and day of softners used (OR = 0.74; 95% CI 0.25-2.21, $p = 0.59$) (Table 3) showed no difference of 2 group (Table 2), the only one case of urine retension in Erbe combined with HET group improved after onetime ICP in hospital care. Only one people had anal stricture in Erbe group who readmitted to our hospital after 1 month of operation accepting the sphincter released procedure based on the chart. These people suffered from postoperative pain attacked high rate in the Erbe combined with HET system group 32.4% (> 3 points) compared to the Erbe system 20% (> 3 points). However, there was no statistic meaning under the Pearson Chi-Square (OR = 1.65; 95% CI 0.46-5.92, $p = 0.44$) (Table 4).

Discussion

New techniques in the surgical management of

Table 3. Comparison of hemorrhoidectomy between Erbe and Erbe + HET system

Categories	≥ 14 days N (%)	< 14 days N (%)	Multivariate analysis OR (95% CI), *p* value
Used of softners			0.74 (0.25-2.21), 0.59[a]
Erbe system (25)	11 (44)	14 (56)	
Erbe system + HET (34)	12 (35.3)	22 (64.7)	

[a] Multivariate analysis; *p* value < 0.005 denotes a statistically signifcant result.
Erbe system: Constant Voltage Regulation with Power Dosing automatically delivers lowest effective adjusted power output in all modes, including both CUT and COAG HET system: The treatment targets the area above the dentate line and its low treatment temperature minimizes collateral tissue damage.

Table 4. Comparison of hemorrhoidectomy between Erbe and Erbe + HET system

Categories	> 3 points N (%)	≤ 3 points N (%)	Multivariate analysis OR (95% CI), *p* value
Pain score			1.65 (0.46-5.92), 0.44[a]
Erbe system (25)	5 (20)	20 (80)	
Erbe system + HET (34)	11 (32.4)	23 (67.6)	

[a] Multivariate analysis; *p* value < 0.005 denotes a statistically signifcant result.
Erbe system: Constant Voltage Regulation with Power Dosing automatically delivers lowest effective adjusted power output in all modes, including both CUT and COAG HET system: The treatment targets the area above the dentate line and its low treatment temperature minimizes collateral tissue damage.

hemorrhoids have led to shorter hospital course, lesser pain after operation and less frequency of postoperative bleeding. In grade III or IV hemorrhoid, the traditional methods like the Milligan Morgan method and the Ferguson's method have been in practice for more than half a century for want of a better alternative.[6] Erbe hemorrhoidectomy had shorter operation time, decreased wound pain, few blood loss and lower rate of postoperative bleeding in comparison of traditional method. In grade I or II hemorrhoidectomy with HET showed lower postoperative wound pain and even not necessary to anesthesia.[5] HET is a novel non-surgical treatment for IH and has been reported to be both safe and effective in several studies.[2,7,8] All these studies were limited for retrospective nature of the study and small sample size. Piskun and Tucker concluded that the treatment with the HET System would cause less procedural pain and less post-procedural adverse events vs existing non-surgical modalities for treatment of IH.[2] Kantsevoy and Bitner conducted a retrospective study of examining the use of HET for the indication of actively bleeding IH. All patients in this cohort (n = 23) tolerated the treatment without any pain or discomfort. No adverse events were reported in the study.[8] Delayed post-hemorrhoidectomy bleeding (DPHB) is an important complication of hemorrhoidectomy and can occur between the fourth and eighteenth day after the procedure.[13] Risk of delayed postoperative bleeding is significantly associated with postoperative constipation in females and with the LigaSure procedure and postoperative constipation in male.[12] In our study, we repeated the HET procedure on grade III or IV hemorrhoidectomy showed there was no difference of pain in two group (Erbe hemorrhoidectomy/Erbe combined with HET hemorrhoidectomy: 20%/32.4% OR = 1.65; 95% CI 0.46-5.92, $p = 0.44$). Due to the post hemorrhoidectomy pain due to sphincter spasm, we implied the pain attack showed no difference in grade III or IV for the Erbe hemorrhoidectomy used in two groups. So, the advantage of HET in grade I or II hemorrhoid in postoperative pain controlled wasn't found in our conclusion. Besides, we didn't find high risk of postoperative bleeding in female with Erbe or Erbe + HET which mention in Lee's study.[12]

The vascular anatomy of the anal cushions inspired many of the original theories of hemorrhoid etiology. The suggestion that a local increase in pressure caused venous dilations within the anal cushions was initially

favored.[7] In our study, the HET system ligation the upper plexus of hemorrhoid and lower rebleeding rate was noted after OPD visited (Rebleeding rate: Erbe/HET + Erbe: 24%/11.8% OR = 1.06; 95% CI 0.26-4.32, $p = 0.93$). The lower bleeding rate after operation may due to the proximal venous plexus of hemorrhoid ligation with HET system. After the hemorrhoidectomy with Erbe system, the opening of post hemorrhoidectomy accompanied with blood vessel opening was ligated from the origin of the vein decreased the rebleeding rate for double ligation of vessel from its distal branch with Erbe system and proximal branch with HET system. Although the application of Erbe system toward proximal branch may happen same result, the narrowing anal canal limited the used of Erbe system on these proximal veins. Both of 2 groups patients returned to our ER for bleeding, postoperative wound pain and urine retension, two patients in Erbe combined with HET hemorrhoidectomy returned to our ER for bleeding and the rest patient returned for wound pain and urine retension. In the Erbe combined with HET postoperative bleeding patients, one woman with underline cirrhosis and the rest man used Plavix and aspirin for cardiac disease. All of these patients improved after compression and no one accepted blood transfusion in this study. Only one patient in Erbe assisted hemorrhoidectomy returned to our ER for postoperative bleeding.

Our procedure provided a new idea for grade III or grade IV hemorrhoid, the safety, lower bleeding rate decreased the readmission to ER rate and worrisome of the patient under the hemorrhoidectomy with Erbe BiClamp®201T DE assisted. The limitations of this study were relatively small sample size (n = 59), lack of specific definition of postoperative bleeding and the rate of post hemorrhoidectomy bleeding is very low (0.4-1.2%),[9,10] definite hemorrhoid vessel location and is our single center experience of HET used. Besides, the new device limited our data base which made the case of Erbe combined with HET hemorrhoidectomy hard to collect in one year. Clavien-Dindo Classifcation provided the bleeding grade may add in the form for the patient to defined the severity of bleeding in the further study.[11] We may collect more and more data in the future and confirmed the conclusion of decreased bleeding rate and improved postoperative pain.

Conclusion

HET combined with Erbe BiClamp®201T DE hemorrhoidectomy may provide a new concept toward hemorrhoidectomy in grade III or grade IV hemorrhoid patients and may decrease the bleeding rate if we collected more patients to provide the statistics evidence in the further research.

Conflicts of Interest

The authors declare no conflicts of interest.

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Self-financing.

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原　著

針對第三與第四級痔瘡使用雙極結紮法與組織凝結儀系統之結果與反應

柯俊嘉　盧建璋

高雄長庚紀念醫院　外科部　大腸直腸外科

目的　運用雙極結紮法與組織凝結儀系統針對第三級與第四級痔瘡治療，降低該群病人術後疼痛與術後出血比率。

方法　回朔性分析單一醫學中心自 2021 年 3 月至 2021 年 11 月共 59 名被診斷第三級或是第四級痔瘡，其中 25 位病患接受組織凝合儀治療，另外 34 名接受新型雙集結紮法合併組織凝合儀，此研究比較兩組織結果與術後反應均納入分析。

結果　針對指使用 Erbe 組痔瘡切除手術和使用 HET 合併 Erbe 組痔瘡切除手術中，單純使用 Erbe 組出血機率為 24% (n = 6/25)，而使用 HET 合併 Erbe 組痔瘡切除手術其出血機率為 11.8% (4/34)，病人使用 HET 合併 Erbe 組痔瘡切除手術出血機率較低，然而統計尚未達顯著差異 (p = 0.93) 此外比較兩組其術後尿滯留，肛門狹窄與使用軟便劑天數，均未達明顯統計上差異 (p = 1)，(p = 0.59) 一位病人產生術後尿滯留之併發症，發現在使用 HET 合併 Erbe 痔瘡切除手術，在導尿後改善出院，而有一位病人接受 Erbe 痔瘡切除手術，產生肛門狹窄之併發症，有重新住院接受括約肌放鬆手術在痔瘡手術後約一個月。此外針對術後肛門疼痛調查中，疼痛大於 3 分在單純使用 Erbe 組中約為 20% (n = 5/25) 對比 Erbe 合併 HET 使用組為 34% (n = 11/34)，在同時使用 HET 合併 Erbe 組中有較高痛機率，但統計尚未發覺顯著差異性 (p = 0.44)。

結論　雙極結紮法合併組織凝結儀之痔瘡切除手術，可能提供一個新的選擇針對第三第四級痔瘡切除手術，並且降低其術後出血之風險。

關鍵詞　痔瘡切除手術、術後出血、雙極結紮法、組織凝結儀。