DOI Number: 10.37506/v14/i1/2020/ijfmt/192907

Harmonic Scalpel Vs Conventional Cautery Use In Hemorrhoidectomy

Khalid K. Hussein

General surgeon, clinical lecturer, Department of surgery, Tikrit university college of medicine, Salah Aldin, Tikrit, Iraq

Abstract

Introduction: The evidence-based literature emphasizes the requirement of prioritizing harmonic scalpel haemorrhoidectomy over the conventional surgical interventions in the context of minimizing the intra-operative and post-operative complications in the treated patients.

Aim: The presented research study evaluated the significance of the harmonic scalpel (HS) as compared to the conventional electrocautery in the context of facilitating safe and effective haemorrhoidectomy in the selected patients. The study question focusses on analysing the potential of HS haemorrhoidectomy in terms of minimizing the post-operative complications in the patients affected with grade III and IV hemorrhoids. The study hypothesized beneficial treatment outcomes of HS haemorrhoidectomy as compared to the conventional electrocautery-based haemorrhoidectomy.

Methodology: The prospective cohort study shortlisted 20 candidates for HS and electrocautery-based haemorrhoidectomies. Initial 10 patients underwent the conventional haemorrhoidectomy; however, the other 10 received HS haemorrhoidectomy.

Result: The research findings categorically revealed limited post-operative pain and bleeding in the harmonic scalpel group as compared to the conventional electrocautery group. HS haemorrhoidectomy substantially reduced the extent of collateral thermal damage in the treated patients.

Conclusion: The study findings affirmed the effectiveness of HS haemorrhoidectomy over traditional intervention in terms of minimizing postoperative complications including bleeding, pain, urinary incontinence, fecal incontinence, anal stricture, and anal abscess.

Keywords: *Harmonic scalpel, Electrocautery, Haemorrhoids, Bleeding, Collateral thermal damage*

Introduction

Harmonic scalpels (HS) include the ultrasonic scalpel instruments that effectively incorporate automatic vessel-sealing systems for undertaking the surgical intervention including hemorrhoidectomy[1]. These scalpels include the hemostatic, electrothermal, and bipolar devices that systematically utilize pressure and radio frequencies in the context of coagulating and dissecting the vessels of 0.7cm diameter. Utilization of harmonic scalpels leads to minimal tissue charring and limited thermal spread that reduce the risk of intraoperative hemorrhage. Harmonic scalpels increase surgical field visibility during hemorrhoidectomy. The concomitant undertaking of hemostasis and resection by the harmonic scalpels results in the reduction of mucosal tissue damage and post-surgical infection[2]. Furthermore, harmonic scalpels' use minimizes the risk of surgical site pain and post-hemorrhoidectomy bleeding in the treated patients. Contrarily, the hemorrhoidectomy through conventional cautery is performed in two distinct stages. The first stage facilitates the damage of blood vessels and mucosal tissues during hemorrhoidal resection.

Corresponding Author:
Khalid K. Hussein
Email id.: dr_khalidkhairy@yahoo.com
Tel No.: 07722958462

The second stage is based on hemostasis and suturing at the resection site. These facts affirm the significance of harmonic scalpels in terms of reducing the intra-operative hemorrhage as well as operation duration.

The analysis by Bulus et al.[3] advocates the significance of the harmonic scalpel in terms of effectively treating the Grade III/IV hemorrhoids and associated complications. Various research studies affirm the safety of HS-based hemorrhoidectomy in comparison to the conventional operative interventions. Patients who undergo harmonic scalpel hemorrhoidectomy rapidly resume their work as compared to other patients who receive conventional hemorrhoid excision interventions in the operative settings[4]. However, evidence-based findings regarding the effectiveness of harmonic scalpel hemorrhoidectomy over conventional techniques, lack scalability. Some of the significant studies do not report any reduction in postoperative pain intensity, bleeding and other post-surgical complications through the prioritized use of an ultrasonic scalpel over conventional hemorrhoidectomy techniques[5]. The analysis by Homayounfar et al.[6] reveals similar thermal injury and greater extent of necrosis under the impact of the ultrasonic scalpel as compared to the conventional monopolar electrocautery. Similarly, the findings by Khan et al.[7] do not reveal the claimed benefits of HS hemorrhoidectomy over traditional electrocautery-based hemorrhoidectomy. These findings radically reveal the limited generalizability of the harmonic scalpel (safety/efficacy-related) findings in the scientific community. This necessitates the requirement of prospective interventions to comparatively analyze the safety and efficacy of HS-based hemorrhoidectomy in comparison to the conventional cautery method.

The analysis by Bilgin et al.[8] affirms the potential of a harmonic scalpel (HS) hemorrhoidectomy in terms of reducing the recurrence of hemorrhoids in the treated patients. The assessment affirms the capacity of the harmonic scalpel in facilitating fast and safe hemorrhoidectomy. The study findings advocated the use of HS hemorrhoidectomy over the conventional stapler hemorrhoidopexy. However, harmonic scalpel-based reduction in the initial postoperative complications, including the post-surgical pain and intra-operative bleeding substantiates the prioritization of this technique in comparison to conventional hemorrhoidectomy approaches[9]. Postoperative pain is the major complication experienced by the treated patients following the administration of hemorrhoidectomy. Harmonic scalpel-based technique is more advantageous as compared to other conventional interventions, including cryotherapy, photocoagulation, sclerotherapy, electrocautery, and rubber band ligation. This is majorly because of limited postoperative pain and decreased lateral thermal trauma (0.5 – 1.5mm) under the impact of harmonic scalpel utilization. The assessment by reveals no rational evidence of the systematic utilization of the harmonic scalpel in hemorrhoidectomy. The study findings also relate the post-operative pain with the extent of thermal injury in the treated patients. Monopolar cautery leads to the thermal injury (up-to 15mm) to the porcine small bowel mesentery during hemorrhoidectomy[10]. This injury substantially elevates the intensity of post-operative pain in the treated patients. Contrarily, the analgesic effect of the harmonic scalpel reduces these outcomes to a considerable extent.

Harmonic scalpel utilizes sound waves that effectively induce vibrations at 55, 000/second in the context of coagulating the medium/small size blood vessels during hemorrhoidectomy[11]. Utilization of conventional electrocautery increases the risk of perianal pain-related post-operative complications including constipation and urinary retention. This eventually elevates patients' treatment burden and length of their hospital stay during the post-operative period[11]. Contrarily, no such clinical complications are reported after utilizing harmonic scalpel during hemorrhoidectomy. This resultantly reduces the operative time and risk of blood loss-related clinical complications in the treated patients[11]. In summary, the HS hemorrhoidectomy is a closed and suture-less intervention that not only saves the operative time, but also increases patient safety to a considerable extent. The reduction in intra-operative and post-operative complications through the utilization of HS technique justifies its benefits over the conventional electrocautery technique in the hemorrhoidectomy-based surgical settings. We hypothesized that the Harmonic scalpel use in hemorrhoidectomy reduces the intra-operative and postoperative complications in comparison to the conventional electrocautery intervention. The presented research study accordingly evaluated the safety and outcomes of HS hemorrhoidectomy while comparing them with the conventional hemorrhoidectomy results.

Methodology

The prospective study selected 20 subjects affected with grade III/IV internal hemorrhoids. These candidates underwent hemorrhoidectomy in the year 2017 in

a private hospital in Tikrit city. Indeed, 10 patients received the conventional monopolar electrocautery-based hemorrhoidectomy. However, the other 10 of them underwent HS hemorrhoidectomy in the operative setting. The medical records of the selected patients were effectively retrieved from the hospital database. The study participants included 9-females and 11-male patients. The entire subjects had to undertake pre-operative lab interventions prior to hemorrhoidectomy. Saline enema was administered to each patient one night before surgery. Administration of prophylactic antibiotics was effectively undertaken before the initiation of surgical hemorrhoidectomy. 15 patients received general anesthesia for hemorrhoidectomy. However, 5 patients (including 2 female subjects) received spinal anesthesia prior to surgery. The surgical field acquisition was performed through anoscope. Forceps were utilized for lifting the hemorrhoidal stems from the anal sphincter.

The conventional hemorrhoidectomy was performed in the selected group through monopolar electrocautery in accordance with the Ferguson's closed hemorrhoidectomy method. The anal sphincter and hemorrhoidal tissue were sequentially excised through the monopolar electrocautery device. The hemorrhoid mucosal resection was followed by hemostasis and closure of the surgical wound by Vicryl 3-0 surgical sutures. Contrarily, the ultrasonic scalpel was utilized for excising the hemorrhoidal pedicle and tissue up-to-the apex region. Vascular forceps were used in the context of minimizing the internal sphincter injury during the intra-operative period. Coagulated blood vessels and hemorrhoidal mucosa were subsequently excised through harmonic scalpel. 3-0 vicryl was used for placing the mucosal sutures.

Acetaminophen (2-tables TDS) were prescribed to each patient for post-operative pain management. Patients underwent 'sitz bath' three times a day during the post-operative tenure. VAS (visual analog scale, 0-10) was utilized for recording the post-defecation/ resting pain, urinary retention, and hemorrhage. The occurrence of fecal incontinence, anal structure, and anal abscess was effectively monitored during the post-operative period. Indeed, 0-10-points on a VAS scale indicated no-pain to severe pain. Major bleeding was identified by the requirement of intensive medical interventions (including close-monitoring, reoperation, blood transfusion). Contrarily, minor bleeding was indicated by the minimal bleeding pattern during defecation that did not require consistent monitoring.

Results

The findings of the prospective study revealed limited post-defecation pain in the patients who received the harmonic scalpel intervention. The pain pattern was marked between the range of 1-2 on VAS scale. However, subjects of conventional electrocautery reported post-defecation pain on the VAS scale of 5-6. Major bleeding was not reported in both study groups. However, electrocautery-based subjects reportedly experienced elevated bleeding as compared to patients who underwent HS hemorrhoidectomy in the surgical setting. The subjects who received electrocautery-based hemorrhoidectomy encountered greater tissue injury that caused increased bleeding and anal pain as compared to the other treatment group. The elevated pain and tissue injury at the surgical site resulted in the clinical complications including fecal incontinence, anal abscess, and urinary retention in the initial treatment group. These postoperative complications variably impacted the study subjects in accordance with the extent of their tissue injury and immunity level. However, the other group did not experience these complications (except minimal anal pain/post-defecation bleeding) to any level during the post-operative period. Therefore, the study findings revealed the safety and efficacy of HS hemorrhoidectomy over the conventional electrocautery-based hemorrhoidectomy in the selected patients.

Discussion

The study findings effectively concord with the evidence-based outcomes that emphasize the effectiveness of HS hemorrhoidectomy over conventional electrocautery intervention in terms of minimizing the hospital stay duration, post-operative pain, blood loss and surgery time[12]. Similarly, the systematic review by Mushaya et al.[4] affirms the efficacy and safety of harmonic scalpel hemorrhoidectomy in terms of enhancing the quality of life and minimizing post-operative pain in the surgically intervened patients.

Numerous research interventions advocate the single-handed utilization of the harmonic scalpel method in comparison to the conventional electrocautery technique. Some studies also emphasize the requirement of the harmonic scalpel with other devices and techniques including the cushion suspension clamp, electric knife, and Milligan–Morgan hemorrhoidectomy for treating stage III/IV hemorrhoids[13]. These mixed

method interventions also generate better outcomes as compared to the conventional electrocautery-based Ferguson's closed hemorrhoidectomy. The analysis by Lohsiriwat[14] emphasizes the effectiveness of non-conventional hemorrhoidectomies over the traditional methods in terms of limited convalescence duration, reduced postoperative pain, and shorter operative time. However, the findings do not indicate the greater effectiveness of non-conventional techniques (related to the long-term outcomes) as compared to the conventional hemorrhoidectomy methods.

The findings of the presented study revealed the reduction in post-hemorrhoidectomy pain under the sustained impact of pain-relieving medication and as well as minimally invasive harmonic scalpel-based intervention. These findings lack generalizability because of the small sample size. However, the findings still prove to be credible in the context of the systematic methodological approaches that the presented study utilized effectively for retrieving the desired outcomes. The findings of the presented study revealed minimum post-defecation pain in patients who underwent harmonic scalpel hemorrhoidectomy in comparison to the conventional technique. These findings effectively concord with the evidence-based outcomes that advocate the effectiveness of Harmonic Scalpel Hemorrhoidectomy in terms of minimizing the risk of sphincter lesions and associated fecal incontinence[15]. Eventually, the absence of post-hemorrhoidectomy continence disorders minimizes the risk of post-defection pain in the treated patients.

Undoubtedly, the harmonic scalpel-based hemorrhoidectomy offers the scope of the concomitant utilization of other non-conventional methods with the core objective of reducing the extent of the lateral thermal injury and resultant postoperative complications. The study by Abo-hashem, et al.[16] revealed similar findings that indicated the reduced risk of excessive lateral thermal injury through the utilization of the harmonic scalpel while undertaking non-conventional hemorrhoidectomy. Similarly, the findings by Ababaikere, et al.[17] reveal the limited risk of thermal injury to the subjacent tissues and resultant postoperative bleeding through the administration of harmonic scalpel-based hemorrhoidectomy. The findings also reveal the effectiveness of harmonic scalpel technique for minimizing the risk of postoperative mucous discharge.

The findings of the presented study revealed the absence of postoperative urinary retention and anal abscess in patient groups who received harmonic scalpel-based treatment. This occurred under the impact of minimal collateral thermal damage during the operative process. Evidence-based research literature substantially affirms these findings while indicating the minimal lacerating impact of harmonic scalpel-based ultrasound waves on the adjacent healthy tissues[18]. The harmonic scalpel-based technique precisely dissects and coagulates the targeted hemorrhoidal tissues, while minimizing the surgical site complications. This eventually reduces the risk of fecal incontinence, urinary retention, and anal abscess during the post-operative period. The conventional electrocautery-based hemorrhoidectomy fails to minimize this post-operative complications that eventually lead to the extended hospital stay and reduced quality of life of the treated patients. These findings categorically support the authenticity of the outcomes of our prospective cohort study that advocates the use of HS hemorrhoidectomy over conventional monopolar electric cautery in the surgical units.

Conclusions

The presented research study effectively authenticated the potential of HS hemorrhoidectomy in terms of minimizing the post-operative complications in the treated patients. The findings revealed a substantial reduction in postoperative bleeding, anal pain, urinary retention, and fecal incontinence through the utilization of the harmonic scalpel as compared to the conventional electrocautery during hemorrhoidectomy. The findings advocate the scalable utilization of HS hemorrhoidectomy for minimizing the post-surgical complications. The findings prove to be a milestone for healthcare professionals and the scientific community in terms of improving the safety and efficacy of hemorrhoidectomy methods for the treated patients. However, the study did not perform a cost-benefit analysis to evaluate the economic implications associated with HS hemorrhoidectomy as compared to the conventional treatments in the operative settings. This substantiates the need for organizing prospective studies to understand the economic implications of HS hemorrhoidectomy in the healthcare sector.

Ethical Clearance: The blood was collected from the a private hospital in Tikrit city after their investigation. Oral consent was taken before enrolled the patients in the study.

Source of Funding: Self

Conflict of Interest: Nil

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