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論 文 内 容 要 旨

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学位論文題目	Functional Evaluation of a Novel Microwave Surgical Device in a Canine Splenectomy Model (犬の脾部分切除モデルにおける新規マイクロ波手術器具機能の検討)		
<p>Background</p> <p>Partial splenectomy remains a difficult procedure in clinical practice because of the fragile parenchymatous texture and high vascularization, which easily result in uncontrolled hemorrhage. Thus, the use of electrosurgical devices with bleeding-controllable functions is essential. Besides, microwave coagulation surgical instruments (MWCX) demonstrated their capabilities in various tissues owing to their unique heating mechanism. However, the application of microwave devices as an independent surgical tools for partial splenectomies has not yet been reported.</p> <p>Objective</p> <p>To assess the utility of microwave surgery (using a commercialized version of MWCX) on partial splenectomies as well as compare its functions with other available energy devices.</p> <p>Methods</p> <p>A version of MWCX (Acrosurg[®]) and ultrasonic dissector named Harmonic Focus (HF) were employed for partial splenectomy in beagles without any prior ligation of splenic vessels. Cutting time, cutting size (width and thickness), and bleeding occurrence were recorded. Cutting area and cutting speed were calculated from the cutting size and cutting time data. Lateral thermal injury (LTI), possible complications were observed immediately and after a 4 week follow-up using microscopic investigation.</p> <p>Results</p> <p>The manual cutting mechanism of Acrosurg[®] required a longer cutting time compared with the automatic cutting mode of HF (301.5 [243.2 – 527.0] vs. 114.5 [106.0 – 135.0] p < 0.01). There was no statistical difference in cutting area or bleeding cases.</p>			

- (備考) 1. 論文内容要旨は、研究の目的・方法・結果・考察・結論の順に記載し、
2千字
程度でタイプ等を用いて印字すること。
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Acrosurg achieved complete hemostasis in all cases, whereas the HF group failed to stop bleeding in two of eight cases, which needed total splenectomies as the final solution. The Acrosurg group exhibited a similar LTI compared with the HF group (3.0 [2.4 – 3.4] vs. 2.7 [2.3 – 2.9] mm, $p = 0.151$), but the LTI of the Acrosurg group tended to shrink more after 4 weeks (1.2 [1.0 – 1.3] vs. 1.7 [1.3 – 1.9] mm, $p < 0.05$).

Discussion

Microwave has been applied in medical fields as an assistant-surgical tool for tumor ablation until the invention of a novel MWCX (microwave scissors) which combined coagulation and cutting functions all in one. Its commercialized version (Acrosurg) demonstrated positive results on vessel sealing, lymphadenectomies or partial hepatectomies. In this study, Acrosurg[®] was set at a relatively low power output (30 W) for partial splenectomy to avoid bursting (at high output) and recurrent bleeding (at very low output). It required more time to finish the procedure than HF because unlike HF which can cut and seal the targeted tissues automatically, surgeons have to observe the sealing site to decide when to cut the tissue safely. During the experiment, HF could not totally control bleeding when it occurred (2/8 cases) whereas 100% of cases achieved hemostasis in Acrosurg[®] group. The results implies that the delayed manual cutting modality of Acrosurg[®] might be a pivotal role to secure a cutting margin in splenectomies. Moreover, microwaves can penetrate all level of treated tissues simultaneously, create frictional heating among water molecules to coagulate the exposed area from the inside to the outside without destruction of the splenic capsule, which prevents the splenic margin from bleeding before transection. Furthermore, despite taking more time for coagulation than HF, Acrosurg[®] did not cause more extended thermal damage. Heat-induced areas by Acrosurg also shrunk significantly compared with HF group.

Conclusion

Partial splenectomies were safely performed in dogs without prior ligation of splenic vessels by a scissor-like microwave energy device which provided manual cutting and simultaneous heating process-based sealing. The combination of manual cutting and sealing capability helps not only provide an appropriate seal time by adjusting cutting timing adaptively but also potentially stop bleeding by using a microwave heating process different from other energy devices.

学位論文審査の結果の要旨

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<p>(学位論文審査の結果の要旨) ※明朝体 11ポイント、600字以内で作成のこと</p> <p>本論文は、周術期出血が多くエネルギー手術器具を使用するのが不可欠である脾部分切除術における新規マイクロ波手術器具の有用性を、ビーグル犬を用いて超音波手術器具と比較検討し、以下の点を明らかにした。</p> <ol style="list-style-type: none">1) 新規マイクロ波手術器具は 10 頭すべてにおいて術後の完全止血を得られたが、超音波手術器具においては 8 頭中 2 頭において再出血を認めた。2) 切開速度は新規マイクロ波手術器具において有意に早かった。3) 術後 4 週間での合併症は認めず、肉眼的に切除部に若干の癒着を認めたのみであった。4) 熱損傷の範囲は術直後では両器具に差はなかったが、4 週間後では超音波手術器具の方が有意に範囲が広がった。 <p>本論文は、脾部分切除術において新規に開発されたマイクロ波手術器具が止血に有用で、術後出血を認めなかったこと、手術時間の短縮につながることおよび熱損傷の範囲が狭く、機能温存にも有用である可能性を明らかにしたもので、本領域の研究に新たな知見を与えたものであり、また最終試験として論文内容に関連した試問を実施したところ合格と判断されたので、博士 (医学) の学位論文に値するものと認められた。</p> <p style="text-align: right;">(総字数 478 字) (令和 2 年 1 月 27 日)</p>			