Vaginal Approach for Uterus Separation During Laparoscopic Hysterectomy

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Every year more than 15.000 total hysterectomy procedures are performed in the Netherlands. From all these procedures, only a minor part is done via a laparoscopic approach. One reason for this is the high complexity of the procedure. The uterus is difficult to reach with the laparoscopic tools and nearby structures are easily damaged. Especially, the separation of the uterus at the fornix needs to be done with great care and is time consuming (i.e., typically takes more than 15–20 min). This results in long procedure times. To resolve part of these difficulties, a new instrument has been designed that enables separation of the uterus via a vaginal approach. The device uses a cutting mechanism to safely separate the uterus from the vagina wall. The design allows the application of an existing manipulator to mobilize the uterus for better access of laparoscopic tools. A prototype of the separation tool, MobiSep, has been manufactured. The new separation principle has been evaluated in a test setup. Over the device a tubular piece of tissue was mounted, resembling the vagina wall. The results show that the time needed for full separation is on average 102 (s). The maximum driving force needed to cut the tissue is found to be 50 (N), which can be applied manually. It is expected that this prototype is intuitive to use, can contribute to the reduction of the complexity of laparoscopic hysterectomy procedures and can reduce the total procedure time.

Design and Prototyping of a Low-Cost Portable Mechanical Ventilator

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This paper describes the design and prototyping of a low-cost portable mechanical ventilator for use in mass casualty cases and resource-poor environments. The ventilator delivers breaths by compressing a conventional bag-valve mask (BVM) with a pivoting cam arm, eliminating the need for a human operator for the BVM. An initial prototype was built out of acrylic, measuring $11.25 \times 6.7 \times 8$ in.^{3} and weighing 9 lbs. It is driven by an electric motor powered by a 14.8 VDC battery and features an adjustable tidal volume up to a maximum of 750 ml. Tidal volume and number of breaths per minute are set via user-friendly input knobs. The prototype also features an assist-control mode and an alarm to indicate overpressurization of the system. Future iterations of the device will include a controllable inspiration to expiration time ratio, a pressure relief valve, PEEP capabilities, and an LCD screen. With a prototyping cost of only $420, the bulk-manufacturing price for the ventilator is estimated to be less than $200. Through this prototype, the strategy of cam-actuated BVM compression is proven to be a viable option to achieve low-cost, low-power portable ventilator technology that provides essential ventilator features at a fraction of the cost of existing technology.