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REVIEW PAPER

Operating room waste management after open and laparoscopic hepatectomy. Is there any possibility of improving it?

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Abstract

Background: Operating rooms worldwide are one of the major sources of plastic waste. In this work we have speculated, that it is possible to limit the amount of waste produced during laparoscopic and open hepatectomies significantly, based on the analysis of single use items and the possibilities of replacing them with multiple use items. For this purpose, all waste produced during straightforward laparoscopic and open liver resections were analyzed, then divided into two groups: obligatory and non-obligatory waste.

Material and methods: During one open and one laparoscopic hepatectomy procedure, we have analyzed all waste produced as the result of the procedures. The waste was divided into two groups: obligatory and non-obligatory waste.

Results: All items used for each operation was separated from the waste bins after operation inside the OR. The members of the research team (M.W., O.P. and A.L.K) discussed each item and qualified it to one of the two categories: obligatory waste or non-obligatory waste. After assigning all waste items into one of the two groups, the non-obligatory waste was packed and weighted. The total weight and number of waste bins used for non-obligatory waste was recorded. Non-obligatory waste after laparoscopic hepatectomy weighted 3800 grams and was packed into two waste bins while after open hepatectomy the non-obligatory waste weighted 1400 grams and was packed into one waste bin.

Conclusions: Even a small reduction in cost of one procedure can translate globally into big savings for the hospitals and obviously for less environmental impact of the hospital waste.

Keywords: environment, laparoscopic hepatectomy, medical waste, open hepatectomy, operating room waste

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Introduction

Hospitals are a major source of waste throughout the world. In the USA alone, healthcare is the second largest waste contributor with over 4 billion tonnes of total waste production per year. Of this number, around 70% of all hospital waste is directly related to operating theatres (OTs) [1]. As medical professionals have become increasingly dependent on single-use instruments, this might be a moment to verify whether this dependency is always rational. If it were possible to limit the amount of waste produced during surgery, this could have a very positive impact on the environment [2]. There are also several indications that such an approach might help to limit costs for hospitals in two different ways: limiting the direct cost of medical supplies [3] and limiting the cost of waste management [2]. This paper concentrates on evaluating the extent to which we can limit operating theatre waste after open and laparoscopic liver resection by simply identifying those single-use items that can be easily replaced by multiple-use items.

Methods

During one open and one laparoscopic hepatectomy procedure, we analyzed all waste produced as the result of the procedures. The waste was divided into two groups: obligatory waste and non-obligatory waste. Non-obligatory waste was defined as single-use items that were opened by the scrub nurse but not used during surgery, single-use items that could have been replaced by multiple-use items and boxes of both types of items mentioned above. The possibility of replacement of a single-use item was defined as the current existence of a commercially available set of multiple-use items that could have been used instead of a single-use one (e.g. multiple-use trocars vs. single-use trocars) and not as a theoretical possibility of replacement (e.g. multiple-use surgical gloves).

Results

All items used for each operation were separated from the waste bins after the operation inside the OT. The members of the research team (M.W., O.P. and A.L.K) discussed each item and placed it into one of the two categories: obligatory waste or non-obligatory waste. After assigning all waste items to one of the two groups, the non-obligatory waste was packed and weighed (Figure 1). The total weight and number of waste bins used for non-obligatory waste were recorded. Non-obligatory waste after laparoscopic hepatectomy weighted 3800 grams and was packed into two waste

bins, while after open hepatectomy the non-obligatory waste weighted 1400 grams and was packed into one waste bin.

Discussion

Over the last few decades we have become accustomed to the ever-growing amount of waste produced by hospitals in general and by operating rooms specifically. The COVID-19 pandemic saw an even higher rate of growth of hospital waste, hopefully to a level that should prove to be a tipping point for us [4]. Many medical professionals realized that the continuous creation of ever higher mountains of medical waste is simply unsustainable in the long run.

Therefore, it is not surprising that opportunities to limit the amount of medical waste are being researched.

An obvious way to limit the total amount of plastic waste in the OT and at the same time to limit significantly the total cost of procedures is, if we so wish, to sterilize and reuse some single-use items. Tempting as it may sound, this strategy is, however, illegal in developed countries, mainly due to the risk of cross contamination [5].

Another simple step is to open only the single-use instruments that will be used during the operation. Once the sterile surgical supplies are opened, they will eventually become part of the OT waste even if they are not used. Hence, they should be opened only when necessary. Although it sounds obvious, it was shown that implementing this approach in a paediatric surgery OT can result in a average of nine items that are not used and not going to waste [6]. This approach is somewhat demanding, as the industry tends to prepare complete sets of single-use instruments for a certain type of surgery. When the possibility of putting together one's own sets of single-use instruments is researched, it may be beneficial in terms of reducing OT waste to eliminate some items from sets of prefabricated disposable items and instruments in order to reduce the total cost of plastic and hand surgery [3].

An important element of the strategy of hospital administrations is always the reduction of costs. Cutting down on the amount of waste can help lower costs in two ways: by directly limiting the cost of single-use items [3] and by lowering the cost of medical waste management [2]. A further result of the successful reduction of waste could be non-directly related to hospital costs. Most probably such an attitude would be considered a positive example of the social responsibility of the hospital management.

Throughout the world, the number of hepatic resections is growing, as is the amount of medical waste produced by HPB surgery. Between 1996

and 1997 in the USA 2097 liver resections were performed [7]. Similar numbers were obtained in the Netherlands (a country with a population roughly 20 times smaller than the USA) between 2014 and 2017 [8]. At the same time, the amount of waste associated with a single operation has also grown.

In the USA it is estimated that the cost of hospital waste management is around 2.36 USD per kg, and it is even higher for OT and ICU waste management at 5.96 USD [2]. While this price may seem modest, we have to consider that the total amount of medical waste produced by American hospitals is roughly 4 billion tonnes per year. This makes medical waste management a multi-billion-dollar business [1].

Conclusions

Even a small reduction in the cost of one procedure can translate globally into considerable savings for hospitals and, obviously, hospital waste has less impact on the environment.

It is naturally impossible to foresee the real impact of the approach proposed in this paper on the cost of hepatic resection, as ours is merely a feasibility study based on two cases. It seems, however, that there exists a significant margin of improvement for the management of OT waste after liver surgery. If we can confirm this via further studies, it may have a positive impact on the environment and at the same time help to reduce the costs of material and hospital waste management [Table 1,2].

Table 1. Details about open hepatectomy and laparoscopic hepatectomy

Surgery type	**Open hepatectomy**	**Laparoscopic hepatectomy**
Type of resection	resection of segment 7	bisegmentectomy s2–s3
Blood loss	100 ml	100 ml
Operating time	2h	2.5h
Transection	transection with single-use energy device and multiple-use bipolar device	transection with single-use energy device
Type of suction	re-usable suction device	single-use suction

Table 2. Differences between non-obligatory and obligatory waste

Non-obligatory waste	Obligatory waste
single-use items that were opened by the scrub nurse but not used during surgery	multiple-use items that were opened by the scrub nurse but not used during surgery
single-use items that could have been replaced by multiple-use items	single-use items that could not have been replaced by multiple-use items (e.g. surgical gloves, sutures)
coverage boxes for one-use items	coverage boxes for multiple-use items

Figure 1. Disposable operating theatre items

Photo by Oleksii Potapov

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