Carbon Footprint For Elective Laparoscopic Right Hemicolectomy

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Introduction

- The NHS has a net-zero CO_2 emission ($kgCO_2e$) target by 2040
- Acute hospitals account for 51% of all NHS emission
- This study is aimed at identifying and quantifying significant greenhouse gas emission (GHG) whilst performing elective laparoscopic right hemicolectomy (LRH)

Methods

- Four consecutive cases of LRH selected and carbon footprint analysed
- Inclusion criteria for analysis: Energy consumption of theatres, carbon dioxide utilisation in pneumoperitoneum, sterilisation, manufacturing and disposal of all surgical equipment
- Exclusion criteria: Pre and post operative course, transport of patients to and from theatre and transport of reusable surgical and anaesthetics equipment
- The average carbon footprint of one LRH was calculated and extrapolated to the total carbon footprint of all LRH, on average 39, across one year in our colorectal unit

Results

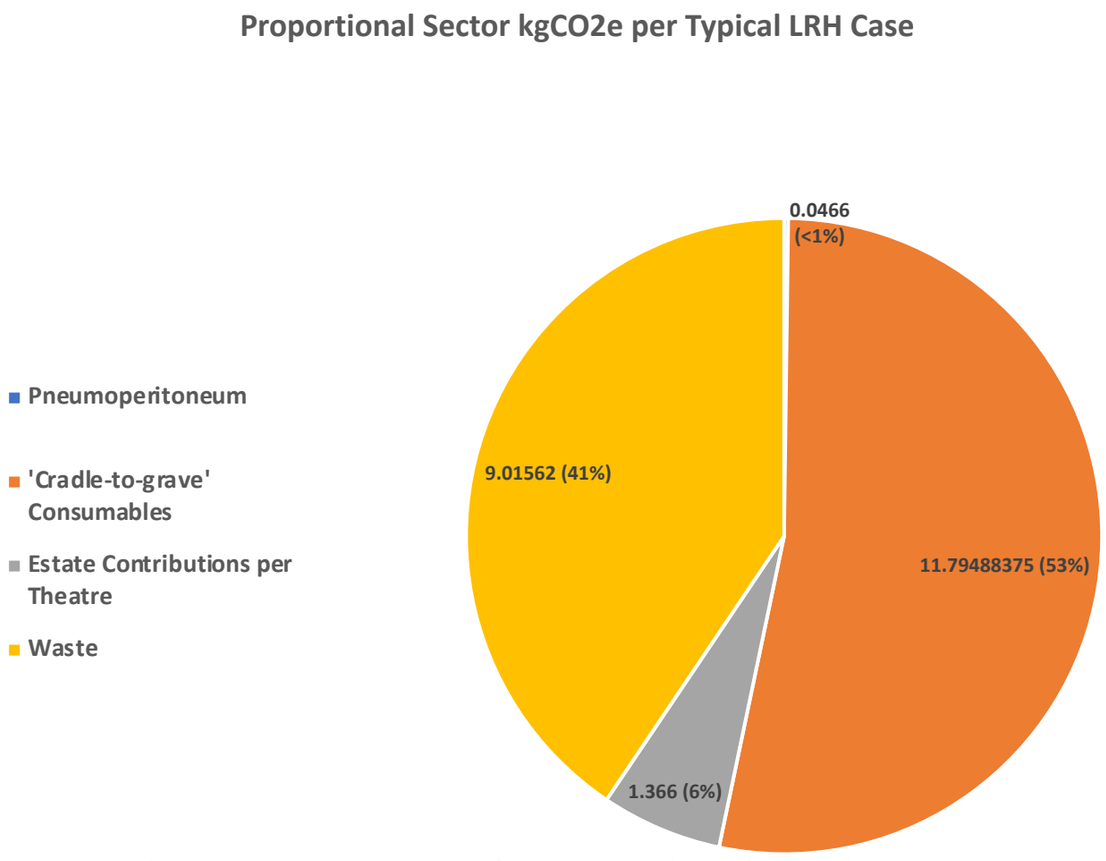

Figure 1 - Total and percentage proportion of $kgCO_2e$ contributed from each measured sector in a typical LRH case

Sub-section	Total $kgCO_2e$
Pneumoperitoneum	0.0466
Cradle-to-grave- Consumables	12.3829213
Estate Contributions per Theatre	1.366
Waste	9.01562
Total $kgCO_2e$/Case	22.8111413
Annual Total $kgCO_2e$	889.634509

Table 1 – Annual $kgCO^2e$ of LRH

	Waste (kg)	Co-efficient (/kg)	Total Waste CO_2
Clinical waste $kgCO_2$/kg	6.52	1.074	7.00248
Domestic waste $kgCO_2$/kg	1.72	0.172	0.29584
Heavy metal recycling $kgCO_2$/kg	1.3	0.021	0.0273
Surgical decontamination $kgCO_2$/kg	5	0.338	1.69
		Total Waste $kgCO_2e$	9.01562

Table 2 – Waste streams per single LRH case

Pneumoperitoneum	
Index Case Litre CO^2 per hour surgery	6.18
$kgCO^2$/L CO^2	0.00198
Average Length LRH Case (hour)	3.83
Total litres CO^2/LRH	23.6694
Total $kgCO^2$/LRH	0.04686541

Table 3- Calculation of $KgCO_2$ derived from direct CO_2 emission to achieve pneumoperitoneum

Discussion

- In the available literature, there are no studies that show the environmental impact of laparoscopic right hemicolectomy
- From the available studies where GHG are shown, $kgCO_2e$ is variable between studies[1]
- Our study has shown that the total $kgCO_2e$ per LRH conducted, falls within the lower scale of what is expected in other operations, as per available literature[2]
- This is underestimated due to limited number of patients in this study and difficulty in data gathering and analysis
- This study identified that the majority of $kgCO_2e$ is derived from indirect sources
- This includes on-site emissions through use of electricity, heating and off-site emissions such as production and transport of products and waste

Conclusion

- This is the first study that has shown the environmental impact of LRH
- The total amount of $kgCO_2e$ produced in a LRH per year in our colorectal unit, is equivalent to driving a petrol car from Kirkcaldy to Doha, Qatar
- This study shares the findings of other sustainability literature in surgery
- The emissions required to produce single use consumables and their subsequent disposal accounts for the majority of $kgCO_2e$
- Identifying sources in significant greenhouse gas emissions can help guide sustainable practice within the surgical field

References:
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2. Whiting A, Tennison I, Roschnik S, Collins M. Surgery and the NHS carbon footprint. Bull R Coll Surg Engl. 2020;102(5):182–5.