

Screwing Our Environment: An Analysis of Orthopaedic Implant Related Waste

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Abstract

Introduction

Medical waste contributes a significant burden to our environment and operating theatres have been shown to disproportionately contribute to healthcare associated waste. In orthopaedics and trauma, a portion of this comes from packaging surrounding implants.

Methods

During a standard open reduction internal fixation of a single malleolus ankle fracture all implant related waste was collected. We recorded the amount of implant related waste associated with each case by weight in grams, and also recorded what proportion of the waste was cardboard vs plastic and what proportion was recycled. A retrospective audit of theatre books was carried out to establish to number of ankle open reduction internal fixations in our unit over the course of one year.

Results

209 patients underwent open reduction internal fixation of an ankle fracture in Galway university hospital between July 2018 and July 2019. In the case studied 144 grams (68%) was cardboard, 42 grams (20%) was hard plastic and 25 grams (12%) was soft plastic. 110 (52%), was from screws alone. In one year, this would account for over 44 kilograms of waste from one type of procedure alone. Of this waste only the hard plastic was recyclable. No theatres contained recycling bins.

Conclusion

Orthopaedic implants contribute a significant amount of operative waste, which could be reduced by decreasing the volume and layers of packaging and encouraging recycling.

Keywords

environment; waste; trauma; theatre; implant; packaging; recycling

Introduction

According to the Lancet and University College London Institute for Global Health Commission report released in 2009 “Climate change is the biggest global health threat of the 21st century”¹. Paradoxically, as healthcare remains one of the largest industries globally, it contributes a significant burden to what remains one of the “hottest” topics of the century. Within healthcare, surgical departments in particular have a sizeable impact on the environment^{2,3}. While the carbon footprint of our operating theatres is multifactorial, including excess energy usage and greenhouse gas production⁴, waste equates to a significant component of this.

Medical waste contributes a significant burden to our environment. In a recent report published by the Environmental Protection Agency in Ireland, our acute hospitals contribute over 10'000 tonnes of waste per annum, much of it high risk medical waste which requires incineration or sterilisation prior to disposal⁵. In this report, 17% of high-risk healthcare waste was attributed to our operating theatres, and operating theatres have been shown to disproportionately contribute to healthcare associated waste⁶. Indeed, studies carried out in other centres worldwide have quoted the burden of operative waste to range from 30%⁷ to as high as high as 70%⁸. This waste carries a significant economic and environmental burden, as medical waste costs over 1800 euros to dispose of per tonne, and often requires additional steps in disposal including incineration and chemical sterilisation.

In orthopaedics and trauma, a portion of this waste comes from packaging surrounding implants, including screws and plates, which often consists of non-recyclable cardboard and single use plastics. While some of this packaging is necessary for sterility, this is not always the case, and alternatives to this system are possible. For example, some manufacturers provide implant sets which are not supplied in single use packaging and are re-sterilised following each case in a similar fashion to surgical implement sets. This naturally contributes overall to less waste.

In this study we aim to assess the burden of waste associated with implant packaging in our operating theatres. For this, we decided to focus on ankle open reduction internal fixation (ORIF), due to its requirement for multiple individually packaged screw and plates to be opened. However, many procedures require a similar implant burden.

Methods

We conducted an in-theatre study of a standard open reduction internal fixation of a single malleolus ankle fracture. During the case, all implant related waste including instructional material, was collected. We recorded the amount of implant related waste associated with each case by weight in grams, and also recorded what proportion of the waste was cardboard vs plastic. We then conducted a retrospective audit of theatre books to establish to number of ankle open reduction internal fixations carried out in our unit over the course of one year.

Following this, for comparison, implant related packaging was collected from a range of common trauma procedures including clavicle ORIF, humerus ORIF, hip hemi arthroplasty and kyphoplasty. This was to illustrate the extent of waste produced across a number of procedures.

Results

In total, 209 patients underwent open reduction internal fixation of an ankle fracture in Galway university hospital between July 2018 and July 2019. In the case studied 211 grams of implant related waste was produced. Of this, 144 grams (68%) was cardboard, 42 grams (20%) was hard plastic and 25 grams (12%) was soft plastic. Overall, 110 (52%), was from screws alone.

Over the course of one year, this would account for over 44 kilograms of waste from one type of procedure alone, excluding elective and revision ankle open reduction internal fixations. Of this waste only the hard plastic was recyclable. Soft plastic was not recyclable, and the type of cardboard used, known as “glossy cardboard” is not currently recyclable.

This also does not account for additional waste generated by more complex cases requiring the use of multiple plates and additional screws. Additionally, the amount of packaging produced will vary between different procedures, with some procedures contributing an even higher burden of waste as illustrated in table 1. Of particular note, each kyphoplasty procedure produces over 3kg of waste in packaging alone.

	Cardboard	Plastic	Total
Ankle ORIF	144	67	211
Humerus ORIF	142	52	194
Clavicle ORIF	222	282	504
Hip Hemiarthroplasty	460	322	782
Kyphoplasty	1800	1300	3100

Table 1. Illustrating the weight of packaging per procedure associated with a number of common orthopaedic procedures

Discussion

Overall, implant related packaging contributes a significant amount of waste in our operating theatres, and much of it is non-recyclable. In the case of recyclable materials, whether or not these are recycled is dependent on the theatre nurse manager on a day to day basis, and how conscious they are in separating waste into recyclable and non-recyclable components. Currently none of our theatres contain recycling bins, and as a result all waste must be sorted through at a later stage to separate recyclable and non-recyclable elements. Based on our study, we would suggest the implementation of a separate recycle bin in theatres to encourage as much recycling as possible.

Another potential solution is the use of ORIF kits which come with a selection of plate sizes and numerous screws etc in sterile sets, which are then re-sterilised between procedures, resulting in minimal physical waste being produced. They also have the added advantage of the operating surgeon being able to see and trial plates while on table, which may contribute to less overall wastage of implants and require less packaging to be opened.

In conclusion, orthopaedic implants contribute a significant amount of operative waste, much of which may be potentially avoidable by reducing volume and layers of packaging. In addition, the use of implant kits which are re-sterilised between procedures is associated with significantly less waste. Given the current appetite for environmentally friendly practices, the onus is now on surgeons to demand more green solutions from implant producing companies, and to encourage increased recycling within our operating theatres.

Declaration of Conflicts of Interest:

The authors have no conflict of interest to declare.

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