



Use of Plastic Products in Operation Theatres in NHS and Environmental Drive to Curb Use of Plastics

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Abstract

Objectives: Objective of this paper is to high light increasing dependence on the plastic products in our surgical theatres and hospitals not only for medical instruments but also common useable of daily lives. To study health, environmental and financial hazards of increasing plastic use in our daily and professional live. Identify reasons behind its usage and how to minimize it.

Methods: We critically analyzed our practice in connection with plastics use in the operation theatres and other part of the hospital. We also performed literature search about history of plastic, hazards on the environment and use of plastics products in the hospitals and the disposition of this plastic waste.

Results: Our observation are that use of plastics and related products in hospital are at increasing trends only for their cost effectiveness, infection control reasons and there is culture and trend towards their use as they are easily available. Unfortunately there is no major drive to put a halt on this practice and there is no drive to reverse these trends and habits.

Conclusion: We have to minimize the use of plastic products in the hospitals by encouraging plastic free culture, change of attitude, legal barriers and legislation, reuse culture and encouraging research in biodegradable products. These changes have to be implemented not only on use of medical equipments but also products we use in our daily lives. This should be part of national and world health agenda.

Introduction

Nature works on some fundamental principles which we consider as nature's norms and which have been functioning since its creation. Biodegradation of materials is the norm of the nature or is called recycling of its basic elements. All natural and biological fuels, animals and plants remains, end up converted into simple compounds and elements to be used up again as natural resources. Human made materials though helped in bringing a revolution in humans lives by providing easily available, abundant, cheap and light weight materials manufactured from easily reproducible and readily available chemicals thus shifting a complete dependence on these non-natural resources. But in the long term that shifts proved costly to the environment, humans and other living being's health. As these are human made synthetic material have been disturbing the fine balance maintained by nature to dispose of the residual waste. Plastic is one of the major and most important chemical that shaped our lives in the last century until today but unfortunately at the expense of natural balance. Today most of the plastic products are completely bio-ungradable. While improving our life styles by using this cheap readily available material we are advertently fighting against nature's norms.

We as humans have damaged our environment more than we can imagine. When this earth was handed over to us it was plastic free. We have done all this for different reasons, which are all linked with our life style and habits. Use of plastic in the shape of plastic bags, plastic toys and lifesaving medical instruments etc is now our nature. As plastics are not biodegradable and due to extensive use plastics is one of the major threats to our environment. The word plastic is derived from the Greek πλαστικός (plastikos) meaning "capable of being shaped or molded" and, in turn, from πλαστός (plastos) meaning "molded"[1,2].

Plastic is not new to our world, it existed in nature form even before we invented it, and rather idea of plastic came from nature itself. Early plastic was bio-derived from materials such as egg and blood proteins, which are organic polymers. In around 1600 BC, Mesoamericans used natural rubber for balls, bands, and figurines [3].

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Figure 1: Brush.

Natural forms of plastics are natural rubber, nitro cellulose; collagen, galalite etc. and synthetic form are example epoxy, polyvinyl chloride, bakelite. But it is not the natural plastic which has become a threat to our environment rather it's over use and synthetic plastic which is now one of the biggest threats to our environment.

Parkesine (nitrocellulose) is considered the first man-made plastic. The plastic material was patented by Alexander Parkes, in Birmingham, England in 1856 [4]. It was unveiled at the 1862 Great International Exhibition in London [5]. Parkesine won a bronze medal at the 1862 World's fair in London.

After World War I, improvements in chemical technology led to an explosion in new forms of plastic, with mass production beginning in the 1940s and 1950s (around World War II) [6]. In 2014, plastic sale of the top fifty companies amounted to US\$ 961,300,000,000 [7]. Many of the top fifty plastics companies were concentrated in just three countries: United States, Japan & Germany.

In developed economies, about a third of plastic is used in packaging and roughly the same in buildings in applications such as piping, plumbing or vinyl siding [3]. Other uses include automobiles (up to 20% plastic) [3], furniture, and toys. In the developing world, the applications of plastic may differ, 42% of India's consumption is used in packaging [3].

There are differing estimates of how much plastic waste has been produced in the last century. By one estimate, one billion tons of plastic waste has been discarded since the 1950s [8]. Others estimate a cumulative human production of 8.3 billion tons of plastic of which 6.3 billion tons is waste, with a recycling rate of only 9% [9]. Much of this material may persist for centuries or longer, given the demonstrated persistence of structurally similar natural materials such as amber [10].

The presence of plastic, particularly micro plastic, within the food chain is increasing. In the 1960s micro plastic were observed in the guts of seabirds, and since then have been found in increasing concentrations [11]. The long-term effects of plastic in the food chain are poorly understood. In 2009, it was estimated that 10% of modern wastes was plastic [6], although estimates vary according to region [11]. Meanwhile, 50% to 80% of debris in marine areas is plastic [11].

Plastics and Medical Field and Hospitals

Today plastic is being used in every shape, toys, crockery, machine, plumbing, medical field etc. Due to its hazards to environment and every living creature from sea to land the world is moving towards plastic free environment and recommendation are coming to minimize uses of plastics due to its hazards to life on land



Figure 2: Plastic glass.

and water both.

Working in NHS (National Health Service) UK, which is one of the leading organizations in the world providing medical care to patients of every age. We being doctors come across different diseases every day and think about their causes and treatment. Therefore it's our responsibility to make our environment free of hazards of plastic which has now become great risk to our health and environment. If not completely free we can make it free to minimum levels.

I believe NHS has to create major institutional drive to make our hospital plastic free. If we look at it, in reality this change should originate from NHS and doctors all over the world because we are the leading health care provider in the world. We should be looking towards plastic free NHS and hospitals all over the world.

Use of plastic goods in hospital has become epidemic and most of it being used in the name of low cost and patient safety. One day I entered the operation theatre and started thinking how much we are dependent on plastics and was surprisingly disappointed that we are using predominantly plastic made instruments and other daily use utensils and doing nothing to avoid it. These plastic instruments and utensils are not only being used extensively in operation theatres but also in other parts of the hospitals. If you go to hospital restaurants you will see plastic cutlery and glasses is being used overwhelmingly.

Our habits have changed from reusable material to disposable material not only in the kitchen but also in operation theatre and wards. I take it as addiction to the use of plastic and disposable material. About 30 years ago most of the things we were using in the hospital and in our daily life were reusable and non-plastic.

Today most of our instrument and accessories used in hospital and operation theatres are disposable and made of plastic. Below is the list of operation theatre instrument and material which were in the past re-useable and now its disposable and plastics. Most common argument for this is infection control and cost effectiveness. As far as infection control is concerned, the reason which is quoted most apart from Hepatitis B, C and HIV for use of disposable instruments is iatrogenic spread of Creutzfeldt - Jakob disease (CJD) through surgical instruments. However fact is that mode of transmission for CJD is not known; de novo spontaneous generation of self-replicating protein has been hypothesized. No clear evidence of risk from diet, previous surgery, blood transfusion, occupational or animal exposure, the possibility that sporadic CJD arises through other unrecognized environmental exposure cannot be dismissed. Iatrogenic CJD infection is inadvertently transmitted usually from a case with CJD in the course of medical/surgical treatment, e.g. human



Figure 3: Plastic.



Figure 4: Plastic and disposable instruments.

pituitary hormone therapy, human Dura mater grafts, corneal grafts or neurological instruments [12].

Despite only four reported patients worldwide, implicating contaminated neurosurgical instruments, and none in the past 30 years, the public health consequences of potential instrument-related iatrogenic CJD can be far-reaching [13].

Laboratory studies indicate that standard decontamination and sterilization procedures may be insufficient to completely remove infectivity from prion-contaminated instruments (Protein causing CJD spread) [14].

Point to be noted is that all these cases have been related to neurosurgical instrument, not other surgical or medical procedures and instruments.

More over another point to be noted here is that when rest of the instruments in the instrument trolley are re-useable then why we use few instruments for the sake of better sterilization or safety. Example all retractors, forceps, needle holders etc. are re-useable. So this argument is baseless to defend use of plastics disposable for prevention of CJD in non-neurosurgical operations. Unfortunately fear of spread of CJD and infection is being used to sell disposable plastic instrument by manufacturing companies which needs further research and investigations. As far as cost effectiveness of disposable instruments is concerned we should not forget the cost we have to pay to dispose of these used instruments plus cost which we are paying in the shape of disturbing and destroying our eco system and risking health of all living beings on the planet including humans. The actual cost effectiveness should be regularly recalculated as once these things become norm in the system they may not be any more cost effective.

Below is the list of theatre instruments which about 30 years ago were all reusable and environmental friendly and now they are disposable made of plastics and related materials which are not environmental friendly rather great threat to our environment. Note this transformation from re-useable non plastic to disposable plastic materials has been gradual over the last 30 years.

The NHS produced 408 218 tons of waste in 2005-6, 29% of which was clinical waste, and spent nearly £73 m (€80 m; \$103 m) on its disposal. This is equivalent to 5.5 kg of waste per patient per day [15]. By comparison, France and Germany, which historically have a greater cultural, political, and statutory commitment to waste minimization and recycling [16], produce only 1.9 kg and 0.4 kg/patient/day, respectively.

About 30% of theatre waste is plastic, mainly from packaging

[17]. The UK generates 100 million tons of solid waste each year, 85% of which ends up in landfill sites in England and Wales. These sites are reaching capacity [18], and have been linked with environmental and health problems [19,20]. One alternative for hazardous waste is incineration, but its use is limited according to the EU Waste Incineration Directive 2000/76/EC to minimize the negative environmental effect of noxious and other emissions. Incineration generates toxic gases into environment which are threat to vegetation, animal and human health. Toxic substances released causes cancers and neurological damage, disrupts reproductive thyroid and respiratory systems. Burning of plastic wastes increase the risk of heart disease, aggravates respiratory ailments such as asthma and emphysema and cause rashes, nausea or headaches, and damages the nervous system [21].

How to reduce the plastic use in NHS and aim for green NHS

Both the UK government and the British Medical Association have recently published strategies for “greener” health care [22,23].

We recommend following measures.

Culture and attitude: Educate staff, patients & public about hazards of plastic usage to environment and future of the earth and life on it. We should discourage use of any plastic related material in the hospital unless it is absolutely necessary example cups, plates other crockery in the hospital. We must encourage use of reusable instruments and material in hospitals.

Professional bodies like BMJ, GMC, Royal colleges etc. will have to play their role and encourage and educate doctors and nurses about hazards of plastic use and its effects on climate change. There is need to organize courses seminars to educate and motivate people to fight climate change.

NHS has been world leader in providing best health care in the world, it's time for NHS to set new standards for Greener NHS and play leading role in climate protection, reducing use of plastic and plastic related material in NHS and outside.

Legal barriers: We have to develop new guidelines and do legislation where we have to allow use plastic disposable instruments and other material only when it is absolutely necessary. We should also ban plastic use for any other purpose throughout NHS example crockery etc.

Develop new guidelines instead of giving blanket cover for not screening high risk individuals with Hepatitis B, C, HIV and CJD and using disposable plastic instruments. We should screen high

Table 1: Theatre instruments.

Current Material	Instrument name	Past Instrument / Reuse able
Non-Woven Polyester, polyethylene , polypropylene, material	1- Theatre Hats.	Cotton or paper
Non-Woven Polyester, polyethylene , polypropylene, material	2- Face mask / Visor mask	Cotton Reuse able
Plastics/Disposable	3- Patients ID Bands	Cotton
Plastics/Disposable	4- Patients Tourniquet	Cotton
Plastics/Disposable	5- Patients files	Paper Reuse able
Plastics/Disposable	6- Observation folders	Paper Reuse able
Plastics/Disposable	7- Plastic Bag Warmer	Cotton
Plastics/Disposable	8- ET Tube	Plastic Reuse able
Plastics/Disposable	9- Urinary Catheter	Plastic
Plastics/Disposable	10- Drapes	Cotton Reuse able
Plastics/ glass	11- Medicine (glass bottles)	Glass Recycle able
cotton	12- Swabs cotton disposable	Cotton Reuse able
Non-woven cellulose paper	13- Alcohol swabs	Cotton Biodegradable
Plastics/Disposable	14- Syringes	Glass Reuse able
Plastics/Disposable	15- Venflon	Plastic
Plastics/Disposable	16- Venflon tubing	Plastic
Plastics/Disposable	17- Suction tubes	Reusable
Plastics/Disposable	18- Yankis suction	Reusable
Plastic	19- Chlorhexidine antiseptic plastic bottles.	Glass Recycleable
Plastics/Disposable	20- Scrub Brushes	Plastic Reuse able
Plastics/Disposable	21- Plastic Bags (domestic, clinical wastes)	Cotton Reuse able
Plastics/Disposable	22- Instrument pouch	Cotton Reuse able
Non-Woven Polyester, polyethylene, polypropylene, material	23- Surgeons aprons / gowns	Cotton Reuse able
Plastics/Disposable	24- Plastic Bags for lab.	Cotton Reuse able
Plastics/Disposable	25- Gloves sterile / non sterile	Plastic/Disposable
	26- Slide / Draw sheet	
Polyethylene back sheet and a soft non-woven sheet	27- Inko Pads	Cotton Towels
Plastics	28- Flowtron	NA
nylon, cotton, spandex, and natural rubber	29- TEDS	NA
Non-Woven Polyester, polyethylene , polypropylene, material	30- Patients Drapes	Cotton
Plastics/Disposable	31- Plastic Drape bags for instruments	Cotton Reuse able
Plastics/Disposable	32- Tapes for Drapes (me fix / ex Fix)	Clips Reuse able
Plastics/Disposable	33- Diathermy wiring / Diathermy itself	Re useable
Plastics/Disposable	34- Suction tubes its tubes	Re useable
Plastics/Disposable	35- Suctions bags with suction machine	Glass/ Re useable
Disposable	36- Cotton swabs	Re useable
Plastics/Disposable	37- Plastics Scrub tube for prep patients surgical field	Cotton Reuse able
Plastics/Disposable	38- Plastic bags for swab counting.	Cotton Reuse able
Plastics/Disposable	39- Disposable knife with plastic handle"	Re useable
Plastics/Disposable	40- Specimen containers	Glass Reuse able
Plastics/Disposable	41- Curtains in recovery	Cotton Reuse able
Plastics/Disposable	42- Suction in recovery	Re useable
Plastics/Disposable	43- Drinking water in theatre	Glass / steal Reuse able
Disposable	44- Swabs and gauzes.	Re useable
Plastics/Disposable	45- Theatre instruments	Re useable
Plastics/Disposable	46- Kidney trays	Re useable steal

Plastics/Disposable	47- Bowels	Re useable steal
Plastics/Disposable	48- Pots	Re useable steal
Plastics/Disposable	49- Water proof dressings other dressings	Cotton
Plastics/Disposable	50- Plastic cover for light handles	Re useable steal
Plastics/Disposable	51- Plastics sharp box	Re useable/glass
Plastic/Disposable	52- LMA	Re useable

risk individuals for infectious diseases. This will result in lesser use of disposable plastic instruments.

Reuse culture: Fear of cross infection has systematically removed re-useable instrument and material from the hospitals. It remains unclear whether the risk of infection is real or perceived with regard to prion (CJD) transmission [24], and whether what is required is more effective sterilization procedures rather than disposable equipment [25,26]. Use of re-useable devices will save money, and would also reduce packaging and clinical waste. As mostly packaging material used in NHS is plastic we should minimize its use and encourage paper and cotton packaging. We should encourage use of instruments made of steel which are reusable and glass which is better recyclable.

Reusable non plastic instruments to be declared as bench mark of standard. Regular re-evaluation of cost effectiveness of disposable plastic instruments as once they become indispensable part of life we don't compare their cost with the reuse able instruments. There should be a system to do these cost checks regularly as our bench mark should always be reuse able instruments. We should also demanding manufacturers to develop reuse able modern instruments instead of plastic disposable instruments. Examples of such instruments are endoscopic and laparoscopic instruments and staplers used for bowel anastomoses etc.

The recycling of glass is more advanced than that of other materials [15]. In 2007, the UK recycled 57% of the glass it used. Glass can be recycled an unlimited number of times without adversely affecting quality. Reduced quarrying and transport costs and lower furnace temperatures mean that for every ton of recycled glass produced, 1.2 tons of raw materials are conserved, compared with the production of virgin glass. Glass products used in anesthesia are contaminated with hazardous materials (drugs). Nevertheless, contaminated glass may be safe to recycle because of the high furnace temperatures (1500°C) used in the recycling process. In practice, recycling of anesthetic bottles has been found to be achievable and financially viable [15,27] (Figures 1-3). Plastic & disposable instruments and material used in one Laparoscopic cholecystectomy (Figure 4).

Research: Development of biodegradable material which can be used instead of plastics is the future. We need to invest in the research in this direction. The Green Chemistry Centre of Excellence at the University of York, has been working with the plastics industry to create a new generation of bio-based polyesters is the future.

Considering all above issues when world is clearly concerned about hazards of plastics for our planets and coming generations, we working in NHS as doctors and nurses hold prime responsibility that we should start making our hospital plastic free and work together to achieve Green Hospitals. Target should be set for hospital to turn green and financial incentives should be given to achieve these targets.

Conclusion

If we want to protect our planet and want to make this planet

safe for our future generations, we have to minimize the use of plastic products in the hospitals by encouraging plastic free culture, change of attitude, legal barriers, new legislation, reuse culture and encouraging research in biodegradable products. These changes have to be implemented not only on use of medical equipments but also products we use in our daily lives. This inevitable change should cover operation theatres, wards, canteen, and the way we serve food to patients and we ourselves use daily life products in the hospitals. This drive of no plastic should be part of national and world health agenda and we being health care should be flag bearer of the change in our society and culture.

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