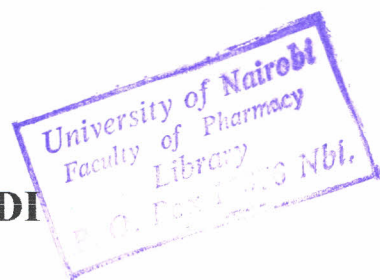


**INVESTIGATION OF SURGICAL DRESSINGS USED IN  
THE KENYATTA NATIONAL HOSPITAL**

**DISSERTATION BY MISIKO LINDA TINDI**

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**A RESEARCH PROJET PRESENTED IN PARTIAL  
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## DECLARATION

I Misiko Linda Tindi declare that this is my original work and that it has not been submitted by any other person for research purpose, degree or otherwise in any other institution.

\_\_\_\_\_  
Sign.

\_\_\_\_\_  
Date

Supervised by: \_\_\_\_\_

Dr. Gatuma

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## **ABSTRACT**

This project was carried out to investigate the surgical dressings used in Kenyatta National Hospital do comply with the British Pharmacopoeia specifications of sterilization, storage, packaging, labeling and quality. Various samples of surgical dressings were collected from the CSSD department and the bulky store and include:- Regal gauze, gauze rolls, cotton wool, plaster of paris and extension strappings.

The samples were run through a number of tests in the B.P. and are:-

Fiber identification

Threads per stated length

Weight per unit area

Absorbency

Loss on drying

Results obtained were compared with the B.P. requirements and conclusions drawn.

This project ensures that the surgical dressings used in hospitals are clean, sterile and up to standard for they are used on patients thus reduces contamination and spread of infections.

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- Protectives

#### A. Primary wound dressing

Term refers to dressings that are designed to be placed next to a wound surface and are reinforced by materials of various types to absorb the wound secretion and minimize maceration. Usually used here is the gauze, which comprises of a suitable mesh and thickness. Has the drawback of adherence leading to pain and trauma caused when a dressing adhered to wound surface is remarked. Petrolatum impregnated gauze possesses hydrophobic characteristics thus doesn't adhere. Dressings are sterilized and packaged in unique envelope that guarantees sterility and can be opened easily under sterile conditions.

Advantages

- The weave is made tight enough so that buds of new skin can't grow through the dressings and become entangled in the filaments.
- Dressings have a side wide stretch, which allows conformability without wrinkling.
- Its versatile thus used in
  - Burns
  - Skin grafts

#### B. Absorbents

##### Absorbent Cotton

Surgical cotton – Cotton is the basic surgical absorbent. Its prepared from the raw fiber by a series of process which remove the natural waxes and are impurities and foreign substances and render fibers absorbent.

*Cotton used is available as;*

##### ➤ Cotton Balls

- Large balls used for obstetrical uses

- Medium balls for applying antiseptics or medication locally and cleaning skin
- Small balls for skin cleansing before hypodermic or intravenous injections and applying local medication to small areas

➤ **Non absorbent bleached cotton**

- Prepared by a modified bleaching process, wherein the water repellent natural oils and waxes are retained
- Well adapted in packing, padding and cushioning of dressings over traumatized areas.

➤ **Surgical Gauzes**

- They provide an absorbent material of sufficient tensile strength for surgical dressings. Its official as absorbent gauzes use.
- Gauze is classified according to its mesh or number of threads per inch. Some types of surgical dressings require a close – meshed gauze for extra strength and greater protection, while other uses such as primary wound dressings, absorbent secondary dressings absorb purulent matter or other drainage requires often, more absorbent gauzes having a more open structure.

Include:-

- **Filmated gauze** – is a folded absorbent gauze with a thin even film of cotton or rayon distributed over each layer. This filmation fluffs up and gives ample dressing volume.
- **Gauze pads or sponges:**
  - Are folded square of surgical gauze used in Kenyatta National Hospital is the Regal gauze.

- Are folded so that no cut gauze edges or loose threads are exposed. This prevents loose fibers from entering the wound.
  - Are folded in the following sizes;
    - 2 x 2 – in - 12 ply
    - 3 x 3 – in – 12 ply
    - 4 x 4 – in – 8 ply
  - Should be packed in temporary packages

➤ **X-Ray detectable gauze**

- Also referred to as x-ray detectable absorbent gauze
- Consists of absorbent cotton ribbon gauze into which is incorporated an x-ray opaque component consisting of distinctly coloured continuous monofilament yarn usually green.
- X-ray detectable component should be securely heat bonded or woven into the fabric.
- Consists of suitable materials not less than 55% of BaSO<sub>4</sub>
- Should be free from loose fibers and particles so as not to impair the softness or flexibility of the ribbon gauze.
- Usually tested for its X-ray opacity. The x-ray detectable component is placed under a 30mm thickness of 99% pure aluminium of commerce and are irradiated simultaneously with x-rays at 70kV using an exposure sufficient to give a logarithmic photographic density of about 1.0 through a 10mm thickness of the aluminium.
- Result – On development of the radiograph, the specimen image to clearly visible as a lighter area against a darker background.
- Used in surgery to reduce bleeding. Can be detected if left in the body.



### Advantages

- Are non- toxic
- Soft
- Non-abrasive
- Can be detected in body
- Don't degrade with time and are not affected by sterilization.

### ➤ Absorbent Cotton Gauze

- Consists of cotton fabric of plain weave bleached to a good white and purified
- Should be
  - Odorless
  - Free from wearing defects
  - Not more than traces of very residues and impurities

### ➤ Sanitary Napkin

- Used in obstetrical, gynaecological and maternity cases used as
  - Obstetrical pads
  - Perimeal pads
  - Maternity pads
- They have a repellent tissue on the side and back surfaces of the napkin to offer greater fluid holding capacity. Used generally to reduce cross – contamination possibilities.

### C) Bandages

- Are used to hold dressings in place by providing pressure or support.

Include

- Muslin bandage rolls
- Gauze roller bandage
- Elastic bandages
- Orthopedic bandages

- Stockinette bandages
- Commonly used in Kenyatta National Hospital are the orthopedic bandages are used to provide immobilization and support in the treatment of broken bones and in certain conditions of bones and joints. Used is Plaster of Paris bandage.
- Consists of a lino-weave bleached cotton gauze impregnated evenly with calcium sulphate which had been dehydrated so that it consists substantially of hemihydrate  $\text{CaSO}_4 \frac{1}{2} \text{H}_2\text{O}$ .
- Bandages of less than 5m have no joins. Joins in longer bandages are made using suitable adhesives and not by sewing.

➤ **Adhesive tapes**

Include; Acrylate adhesives and rubber based adhesives.

a) ***Acrylate Adhesives*** are used as surgical tapes

- Are hypoallergic in nature
- Have an excellent shelf life because they are'nt affected by heat, light or air.
- Non-occlusive
- Don cause overhydration of stratum corneum

b) ***Rubber based adhesives***

- Used where heavy support and a high level of adhesion are required.

***Protectives***

- Impermeable materials intended to be used adjunctively with other dressing components to prevent the loss of moisture or heat from a wound site or to protect clothing from wound exudates

## 1.1 Investigations

### Types of Surgical Dressings used in Kenyatta

- Gauze bandages 20mm x 6mm
- Gauze bandages 2.5mm x 4m
  - 5mm x 4m
  - 7.5mm x 4m
  - 10cm x 4m
  - 5.0mm x 9m Cotton bandage
  - 7.5mm x 9m Cotton bandage
- Cotton wool
- Elastoplast 1", 2", 3"
- Gauze Rolls
- Orthopedic padding 10 cm
  - 15 cm
  - 20 cm
- Plaster of Paris 10 cm
  - 15 cm
  - 20 cm
- Strappings 1", 2", 3", 4", 5", 6"
- Filmated surgical swabs
- Sanitary towels
- X-Ray detectable gauze
- X-Ray detectable pledgets
- X-Ray detectable swabs
- Brain swabs

The most commonly used ones are:-

- Gauze bandages
- Gauze rolls
- Regal gauze swabs
- Cotton wool
- Plaster of Paris
- Strappings
- Elastoplasts
- X-Ray detectable gauze

**1.2 The surgical dressings are manufactured by the following companies:-**

- Cotton wool – East African Cotton industries
- Gauze rolls – Lascard Limited, Medi Cell, Pharma World
- Regal gauze swabs – Regal Pharmaceutical Industries
- Plaster of Paris – Smith and Nephew Industry

- ❖ Are supplied to the Kenyatta National Hospital, bulky stores where they then supply to different departments after sterilization at the CSSD department.

### 1.3 STERILIZATION

Surgical dressings are sterilized in the Kenyatta National Hospital depending.

- Nature of the material that is whether its cotton, viscose, polyether etc
- Extent of contamination
- Type of contamination
- Conditions under which the product was prepared

Materials should be free as possible from microbial contamination (the lower the contamination, the greater the margin of safety).

#### Methods of sterilization

##### 1) Heating in an autoclave

- Materials are sterilized by heating in saturated steam under pressure. The following combination of temperature and time are used:-

Holding temperature	Minimum holding time (minutes)
115° - 118°	30
121° - 124°	15
126° - 129°	10
134° - 138°	3

- These conditions are maintained through out the load during the holding period of the sterilization cycle.
- The steam used shouldn't contain more than 5% of entrained moisture. In the C.S.S.D department in Kenyatta National Hospital, most dressings are sterilized by maintaining a temperature of 134° - 138° for 3 minutes, though conditions are chosen usually with regard to stability of the dressings.

## **2) Dry Heat Sterilization**

- Usually used for heat stable impregnated dressings.
- Dressings are put in aluminium foil containers and heated for 1 hour at 150°C carried out in an electrically heat sterilized oven with forced air circulation.

## **3) Exposure to ionizing radiation**

- Dressings are exposed whilst in final containers to ionizing radiation in the form of gamma radiation from a suitable radio isotopic source usually (cobalt 60) or electrons energized by a suitable electron accelerator. Dose frequently is usually 25KGy (2.5 Mrads)
- These sterilized methods alone ensure the materials are free from contamination thus meeting the B.P. specifications.

## **1.4 PACKAGING**

- Suitable packages are used which protect the surgical dressing from contamination with extraneous solids and they should not allow contents to be released unintentionally under normal conditions of handling, transportation and storage.
- Sterile surgical dressings are supplied in suitable sealed packages that maintain sterility of the dressings until package is opened.

## **1.5 STORAGE**

- Stored in
  - dry
  - well ventilated
  - at temperatures not greater than 25°C
- Adhesive dressings e.g.
  - Plaster of Paris

- Elastoplast
- Extensive strappings shouldn't be allowed to freeze

### **1.6 LABELLING**

- Dressings should be well labeled and should include the following information in their packages;
  - Name of the dressing
  - State whether it is sterile
  - State whether more than one type of surgical dressing is described in the monograph, the type of number of product e.g - Elastoplast 1,2
    - Plaster of Paris 1,2,3
  - If its dyed or coloured and what colour
  - If a permitted antiseptic or medicament is present the name is given and appropriate particulars. E.g. Chlorhexidine Hydrochloride.

## **CHAPTER 2**

### **2.0 EXPERIMENTAL**

#### **PROCEDURE AND RESULTS**

##### **METHODS OF TESTING FOR SURGICAL DRESSINGS**

- The following tests were carried out to see whether the surgical dressing used in Kenyatta National Hospital comply with B.P. specifications

### **2.1 FIBRE IDENTIFICATION**

#### **COTTON**

- a) When examined under a microscope, each fiber is seen to consist of a single cell in the form of a flattened tube with thick and rounded walls.
- b) Fibers were treated with Iodinated Zinc Chloride

### **RESULTS**

#### **Surgical Dressings**

##### **Name**

- |                                |                                     |
|--------------------------------|-------------------------------------|
| ❖ Absorbent Cotton             | <input checked="" type="checkbox"/> |
| ❖ Plaster of Paris             | <input checked="" type="checkbox"/> |
| ❖ Regal gauze                  | <input checked="" type="checkbox"/> |
| ❖ Gauze roll                   | <input checked="" type="checkbox"/> |
| ❖ Extension strappings/plaster | <input checked="" type="checkbox"/> |

- Complies with Test A and B.

Test B; the surgical dressings comply with test B for the fibers turn violet.



## 2.2. THREADS PER STATED LENGTH

### 1) UNSTRETCHED

#### METHOD 1

- The number of threads over a distance of 10cm was determined of the material. A repeat determination at four other independent positions selected was done as being representative of the material being examined. Average number of threads per 10 cm was then calculated.

## RESULTS

### 1) X-Ray detectable gauze

Position 1 – Over a distance of 10cms – 50 threads

	Positions 1	2	3	4
Horizontally	80	50	55	60
Vertically	50	80	95	80
Total	130	130	150	140

$$\text{Average number of threads} = \frac{130 + 130 + 140 + 150}{4}$$

$$= \underline{\underline{137 \text{ threads}}}$$

## 2) Regal Gauze

	Positions 1	2	3	4
Horizontally	70	68	70	70
Vertically	100	100	100	96
Total	170	168	170	166

$$\text{Average number of threads} = \frac{170 + 168 + 170 + 166}{4}$$

$$= \underline{\underline{168 \text{ threads}}}$$

## 3) Gauze rocks

	Positions 1	2	3	4
Horizontally	80	81	78	80
Vertically	62	59	62	70
Total	142	150	140	150

$$\text{Average number of threads} = \frac{130 + 130 + 140 + 150}{4}$$

$$= \underline{\underline{145 \text{ threads}}}$$

## Method IV

- The numbers of warp and weft threads in an area of 10cm x 10cm was determined for the materials and average number of threads per 10cm in the warp and in the weft determined.

## RESULTS

### *Average number of threads/10cm*

- Regal gauze
  - Warp 68 - 77
  - Weft 40 - 49
- Plaster of Paris
  - Warp 142 - 156

(after freeing the fabric from Weft 70 – 80 the plaster of paris by shaking).

- Extension Plaster/Strapping      Warp 79  
  Weft 180
  
- Gauze rolls                                  Warp 69 - 77  
  Weft 41 – 48
  
- X-Ray detectable gauze               Warp 54  
  Weft 70

### 2.3 WEIGHT PER UNIT AREA

#### Non - Adhesive dressing

##### Method 1

- Weight of the material being examined was determined Wg.
- Its unstretched width (a) and fully stretched length (b) was determined.
- Weight per unit area was calculated using the expression  $10,000 \frac{W}{ab}$  in  $\text{gm}^{-2}$

#### RESULTS

- Regal Gauze

$$W = 6\text{g}$$

$$20 \times 250 = 5000$$

$$\text{Weight per unit area} = \frac{10,000 \times W}{ab} = \frac{10,000 \times 6\text{g}}{5000}$$

$$= 12 \text{ gm}^{-2}$$

- Extension Strapping

$$W = 10\text{g}$$

$$20 \times 25 = 500$$

$$\begin{aligned} \text{Weight per unit area} &= \frac{10,000 \times 10\text{g}}{500} \\ &= 200 \text{ gm}^{-2} \end{aligned}$$

- Plaster of Paris

$$W = 4.8\text{g}$$

$$20 \times 100 = 2000$$

$$\begin{aligned} \text{Weight per unit area} &= \frac{10,000 \times 4.8\text{g}}{2000} \\ &= 24 \text{ gm}^{-2} \end{aligned}$$

## 2.4 ABSORBENCY

Apparatus used was a beaker at least 12cm in diameter and filled with water to a depth of 10cm.

### 1. SINKING TIME

#### Method II

- Using forceps a sample of the material weighing 1g was allowed to drop lightly onto the surface of water at 20°C contained in the beaker described above. Using a stopwatch, the time taken for the sample to sink below the surface of the water was recorded.

<u>Results</u>	<u>I trial</u>	<u>II trial</u>
Surgical Dressing	Sinking time (seconds)	
Absorbent cotton	10	10
Regal gauze	8.0	7.0
Gauze roll	8.0	8.0
X-Ray detectable gauze	10	9.0
Narrow Ribbon gauze	9.6	9.0

	<u>Average sinking time of two trials</u>
Absorbent cotton	10
Regal gauze	7.5
Gauze roll	8.0
X-Ray detectable gauze	9.5
Narrow Ribbon gauze	9.3

## **2.5 LOSS ON DRYING**

### **Method 1**

- Boil 5g with 700ml of water for 30 minutes, stirring frequently and replacing the water lost by evaporation
- Decant the liquid into a beaker. Evaporate 400ml and dry the material to constant weight at 100° to 105°

### **RESULTS**

#### **❖ Absorbent Cotton**

- Original weight = 5g
- After boiling and drying to constant weight = 4.1 g
- Loss on drying = 5.0

$$\begin{array}{r} - 4.6 \\ 0.4 \end{array}$$

$$= 0.4 / 5.0 \times 100 = \underline{\underline{8\%}}$$

#### **❖ Absorbent Cotton gauze (Regal gauze)**

- Original weight = 5g
- After boiling and drying to constant weight = 4.4 g
- Loss on drying = 5.0

$$\begin{array}{r} - 4.8 \\ 0.2 \end{array}$$

$$= 0.2 / 5.0 \times 100 = \underline{\underline{4\%}}$$

**CHAPTER 3****3.0 DISCUSSION AND CONCLUSIONS*****Conclusion Experiment 2.1***

Complies with the B.P specification of test A and B substances passed the tests.

***Conclusion 2.2***

Surgical Dressings pass the test for they comply with the B.P. specifications as below:-

- Regal gauze - warp 69 – 77  
- weft 41 – 49
- Plaster of Paris bandage - warp 143 – 157  
- weft 71 – 79
- Extension strapping/plaster - Warp – 82  
- Weft – 190

***Conclusion 2.3***

Comply with the B.P. specifications.

***Conclusion 2.4***

They passed the test thus do comply with the B.P. specification, which states tat the sinking time should not be more than 10 seconds

***Conclusion 2.5***

The substances passed the test for loss on drying they do comply with the B.P. specification which states that the test for loss on drying, on drying to constant weight at 100° - 105°, the materials shouldn't loss not more than 8% of their original weight.

Since all the surgical dressings passed the tests carried out in the experiments above, they therefore meet the required standards. This is of great importance for they are used on patients thus reduces contamination on wounds and also during surgical procedures.

## **RECOMMENDATIONS**

These investigation was carried out in Kenyatta National Hospital. Since surgical dressings are used in all hospitals, private and district hospitals. It would be advisable to carry out these tests based on samples used in other hospitals.

The following tests were not carried out due to lack of resources. Thus further research carried out in these project should incorporate these tests.

- Water-vapour permeability
- Content of antiseptics
- Sulphated ash of surgical dressings
- Water retention capacity
- Research should be done on samples obtained from other hospitals.

## CHAPTER 4

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