

**HEMORRHOIDS TREATMENT TECHNIQUES  
ANALYSIS USING FUZZY LOGIC TECHNOLOGY**

**A THESIS SUBMITTED TO THE GRADUATE  
SCHOOL OF APPLIED SCIENCES  
OF  
NEAR EAST UNIVERSITY**

**By  
ABDULAZIZ TABBAKHA**

**In Partial Fulfillment of the Requirements for  
the Degree of Master of Science  
in  
Biomedical Engineering**

**NICOSIA, 2020**

**ABDULAZIZ TABBAKHA      HEMORRHOIDS TREATMENT TECHNIQUES  
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**NEU**



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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name:

Signature:

Date:

**To all Disease's fighters World Widely**

**Abdulaziz Tabbakha: HEMORRHOIDS TREATMENT TECHNIQUES ANALYSIS  
USING FUZZY LOGIC TECHNOLOGY**

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of Applied Sciences**

**Prof. Dr.NadireÇavuş**

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## **AKNOWLEDGEMENT**

The first thankfulness are my parents for all their efforts from my birth to these moments, you are everything I love you the most love Mr. Mohammed Khir and Mrs. Rima Al-Halabi.

I am pleased to thank everyone who advised, guided, directed, or contributed me in preparing this thesis by referring to the required references and resources at any stage of its stages. I especially thank my honourable Supervisor Assist. Prof. Dr. Dilber Uzun Ozşahin for supporting and guiding me by advising, correcting, and choosing the title and subject, as well as my thanks to the head of the department of Biomedical Engineering at Near East University Prof. Dr. Ayşe Günay Kibarer who helped, advised, taught me, and was like a second mother to me and to all the faculty students. Thanks to Mrs. Safa Anmar Ameen for all the help and advising she offered to me all the way until I completed the thesis and thanks to all of my friends and my old college doctors at Sudan University of Medical Sciences and Technology which are started supporting me from the beginning of my learning journey. Thanks to all people and scientists who are fighting for peace and better life to all the world creatures.

## ABSTRACT

Haemorrhoids or piles is a very painful common disease in all human life stages. The likely of haemorrhoids increases with aging. It is very important to discover the disease in its early stages to be able to cure it in the easier way and don't need to do the complex operations. Although still we can cut it even in the late stages but it will be harder and causing a lot of pain to the patient. The haemorrhoids occurs in 1 per 20 people in USA, and 50% of the people over than 50 years old have haemorrhoids. For this reason, it is very important to study the treatment techniques. The main aim of this study is to give more information about the parameters that affects the different treatment techniques and operations of haemorrhoids and how these parameters affect the preference ranking of each treatment technique. In this study, the most common hemorrhoids treatment techniques to be discussed (Fiber-diet with water, The enema, Ice usage, Creams, IR coagulation, Rubber band ligation and Sclerotherapy) as nonsurgical techniques and (Stapled hemorrhoidectomy, Laser hemorrhoid surgery, Open or Closed hemorrhoidectomy) as surgical techniques which are all operations, all of these techniques will be compared based on some parameters that will affect the outcome of each one of them differently to know which one is the best technique in both categorizations and it is will be preferred to be used in most cases of the disease. These parameters to be used in this study are (Total cost, Efficiency, Recovery period, Survival rate, Practicality, Comfortability, Hospitalization time and Procedure time), all of the parameters depend on the previously recorded results in the popular medication references and websites. After the available results recorded, the treatment techniques will be analyzing and ranking will be evaluated and compared using an artificial intelligence technique which is a kind of fuzzy PROMETHEE.

**Keywords:** Hemorrhoids; Anal canal; Hemorrhoidectomy; Artificial intelligence; fuzzy

PROMETHEE; multi-criteria decision making



## ÖZET

Hemoroidveyabasurtümümsanyaşamevrelerindeçoğağrılıyaygınbirhastalıktır.Hemoroidolasılığı yaşlanmaileartar.Dahakolaybirşekildedaviedebilmekvekarmaşıkışlemleriyapmanızagerekkal mamasıiçinhastalığıerkenevrelerindekişfetmekçokönemlidir.Yine de geçaşamalarda bile kesebiliriz, ancakdahazorolacakvehastayaçokacıçekecektir.Hemoroid Amerika BirleşikDevletleri'ndeki her 20 kişidenbirindegörülvürve 50 yaşınüzerindekiinsanların% 50'sinde hemoroidvardır. Bu nedenle, tedaviteknikleriniincelemekçokönemlidir.Bu çalışmanın temelamacı, hemoroidlerin farklıtedavitekniklerini ve operasyonlarını etkileyen parametreler ve bu parametrelerin her tedavitekniklerinin tercihsıralamasının nasıl etkilediğihakkında daha fazla bilgi vermektir. Bu çalışmada tartışılacak en yaygın hemoroid tedaviteknikleri (Suilelif-diyet, Lavman, Buz kullanımı, Kremler, IR pıhtılaşması, Lastikbant ligasyonu ve Skleroterapi) gibicerrahi olmayan teknikler olarak ve (Zımbalanmış hemoroid dektomi, Lazer hemoroid cerrahisi, Açık veya Kapalı hemoroid dektomi) gibicerrahiteknikler olarak hangileri hepsi operasyon, tüm bu teknikler, her ikikategorizasyonda hangisinin en iyiteknik olduğunubilmekiçin her birinin sonucunufarklı şekilde etkileyecek bazı parametreler edayanı olarak karşılaştırılacak ve hastalığın çoğudurumunda kullanılması tercih edilecektir. Bu çalışmada kullanılacak bu parametreler (Toplam maliyet, Verimlilik, İyileşme süresi, Hayatta kalma oranı, Pratiklik, Rahatlık, Yatış süresi ve Prosedür süresi), tüm parametreler popüler ilaç referanslarında ve web sitelerinde önceden kaydedilen sonuçlara bağlıdır. Sonuçlardan sonra, tedavitekniklerianaliz edilecek ve sıralamabirtür bulanık PROMETHEE olanyapayzekateknikğikullanılarak değerlendirilecek ve karşılaştırılacaktır.

**AnahtarKelimeler:** Hemoroid; Anal kanal; hemoroidektomi; Yapayzeka; bulanık PROMETHEE; çokölçütlükararverme

## TABLE OF CONTENTS

<b>AKNOWLEDGEMENT</b> .....	ii
<b>ABSTRACT</b> .....	iii
<b>ÖZET</b> .....	iv
<b>TABLE OF CONTENTS</b> .....	v
<b>LIST OF FIGURES</b> .....	vii
<b>LIST OF TABLES</b> .....	ix
<b>LIST OF ABBREVIATIONS</b> .....	x
<b>CHAPTER 1: INTRODUCTION</b>	
1.1. Thesis Problem.....	3
1.2. Aims of the Study.....	3
1.3. Significance of the Study .....	4
1.4. Limitations of the Study.....	4
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1. Anatomy of Pelvis area .....	5
2.2. Pelvis Area Components .....	6
2.2.1. Pelvic Bones.....	6
2.2.1.1. Sacrum Impotence.....	6
2.2.1.2. Coccyx.....	6
2.2.1.3. Obturator foramen .....	7
2.2.1.4. Pelvic Base .....	7
2.2.2. Pelvic Muscles .....	7
2.2.3. Pelvic blood vessels .....	8
2.3. Medical vision of Hemorrhoids .....	10
2.3.1. Anatomy and Pathophysiology .....	11
2.3.2. Pathogenesis.....	12

### **CHAPTER 3: HEMORRHOIDS TREATMENT TECHNIQUES**

3.1. NonSurgical Treatment Techniques of Hemorrhoids .....	14
3.1.1. Fiber-Diet & Water .....	14
3.1.2. The Hemorrhoids Enema .....	15
3.1.3. Hemorrhoids treatment using Ice .....	17
3.1.4. Many creams .....	18
3.1.5. Infrared coagulation .....	19
3.1.5.1. Advantages and Disadvantages of IR coagulation .....	21
3.1.6. Rubber band ligation .....	21
3.1.7. Sclerotherapy .....	22
3.2. Surgical Treatment Techniques of Hemorrhoids .....	24
3.2.1. Stapled Hemorrhoidectomy .....	24
3.2.2. Laser hemorrhoid surgery (Doppler technique) .....	25
3.2.3. Open or Closed Hemorrhoidectomy .....	26
3.3. Literature Review .....	28

### **CHAPTER 4: PARAMETERS**

4.1. Total Cost .....	30
4.2. Efficiency .....	31
4.3. Recovery Period .....	31
4.4. Survival Rate .....	31
4.5. Practicality.....	31
4.6. Comfortability .....	32
4.7. Hospitalization Time .....	32
4.8. Procedure Time .....	32

### **CHAPTER 5: METHODS**

5.1. Fuzzy Logic .....	33
5.2. Multicriteria Decision-Making (MCDM) .....	33
5.3. Fuzzy PROMETHEE methods .....	33
5.3.1. PROMETHEE I & II spatial ranking .....	36
5.4. Application of PROMETHEE to the Project .....	37

### **CHAPTER 6: RESULTS AND DISCUSSION**

6.1. Discussion .....	41
-----------------------	----

6.2. Discussion .....	55
-----------------------	----

**CHAPTER 7: CONCLUSION**

<b>REFERENCES.....</b>	<b>57</b>
------------------------	-----------

**LIST OF FIGURES**

<b>Figure 2.1:</b> Anatomy of the gluteal muscles in the human buttocks.....	5
<b>Figure 2.2:</b> Bones of the Pelvic girdle.....	7
<b>Figure 2.3:</b> Muscles of the pelvic area.....	8
<b>Figure 2.4:</b> Blood Vessels of the Pelvis.....	9
<b>Figure 2.5:</b> The Differences Between the Male and Female Pelvis.....	10
<b>Figure 2.6:</b> anatomy of anorectal area.....	11
<b>Figure 2.7:</b> external and internal haemorrhoid.....	12
<b>Figure 2.8:</b> Areas where hemorrhoids occur more commonly.....	13
<b>Figure 3.1:</b> some high-fiber foods.....	15
<b>Figure 3.2:</b> some enema shapes.....	16
<b>Figure 3.3:</b> freezing bags for treating Hemorrhoids.....	18
<b>Figure 3.4:</b> Walgreens Hemorrhoidal Pain Relief Crea.....	19
<b>Figure 3.5:</b> IRC device and procedure place.....	20
<b>Figure 3.6:</b> Rubber band ligation procedure way.....	22
<b>Figure 3.7:</b> Sclerotherapy treatment.....	23
<b>Figure 3.8:</b> Stapled Hemorrhoids operation.....	25
<b>Figure 3.9:</b> Laser operation for hemorrhoid.....	26
<b>Figure 3.10:</b> Hemorrhoidectomy short explanatio.....	27
<b>Figure 6.1:</b> Action Profile of Fiber-Diet with Water for (NSHTTs).....	42
<b>Figure 6.2:</b> Action Profile of Creams for (NSHTTs).....	42
<b>Figure 6.3:</b> Action Profile of hemorrhoids treatment using ice for (NSHTTs).....	43
<b>Figure 6.4:</b> Action Profile of Sclerotherapy for (NSHTTs).....	43
<b>Figure 6.5:</b> Action Profile of Enema for (NSHTTs).....	44
<b>Figure 6.6:</b> Action Profile of IR Coagulation for (NSHTTs).....	44

**Figure 6.7:** Action Profile of Rubber band ligation for (NSHTTs)..... 45

**Figure 6.8:** Positive and Negative Ranking of hemorrhoids treatment techniques for (NSHTTs)..... 45

**Figure 6.9:** Action Profile of Stapled Hemorrhoidectomy for (SHTTs)..... 46

**Figure 6.10:** Action Profile of Open or Closed hemorrhoidectomy for (SHTTs)..... 47

**Figure 6.11:** Action Profile of Laser Hemorrhoid surgery for (SHTTs)..... 47

**Figure 6.12:** Positive and Negative Ranking of hemorrhoids treatment techniques for SHTTs ..... 48

**Figure 6.13:** Action Profile of Fiber-Diet with Water for (THTTs).....49

**Figure 6.14:** Action Profile of Creams for (THTTs).....50

**Figure 6.15:** Action Profile of treatment using ice for (THTTs).....50

**Figure 6.16:** Action Profile of Sclerotherapy for (THTTs)..... 51

**Figure 6.17:** Action Profile of Enema for (THTTs)..... 51

**Figure 6.18:** Action Profile of IR Coagulation for (THTTs)..... 52

**Figure 6.19:** Action Profile of Rubber band ligation for (THTTs)..... 52

**Figure 6.20:** Action Profile of Stapled Hemorrhoidectomy for (THTTs)..... 53

**Figure 6.21:** Action Profile of Open or Closed hemorrhoidectomyfor (THTTs)..... 53

**Figure 6.22:** Action Profile of Laser Hemorrhoid surgery for (THTTs)..... 54

**Figure 6.23:** Positive and Negative Ranking of hemorrhoids treatment techniques for THTTs..... 54

## LIST OF TABLES

<b>Table 4.1:</b> Hemorrhoids Treatment Techniques and Their Detailed Parameters .....	30
<b>Table 5.1:</b> Information table for PROMETHEE method.....	34
<b>Table 5.2:</b> Various Types of criteria by (1986, Vincke).....	35
<b>Table 5.3:</b> Parameter Values of hemorrhoid’s treatment techniques.....	37
<b>Table 5.4:</b> Linguistic scale of importance for nonsurgical treatments.....	38
<b>Table 5.5:</b> Visual PROMETHEE Statistics of Hemorrhoids nonsurgical treatment techniques.....	38
<b>Table 5.6:</b> Linguistic scale of importance for surgical treatments.....	39
<b>Table 5.7:</b> Visual PROMETHEE Statistics of Hemorrhoids surgical treatment techniques.....	39
<b>Table 5.8:</b> Linguistic scale of importance for all hemorrhoids’ treatments.....	40
<b>Table 5.9:</b> Visual PROMETHEE Statistics of all hemorrhoids’ treatment techniques .....	40
<b>Table 6.1:</b> Complete ranking for Nonsurgical Hemorrhoids Treatment Techniques (NSHTTs).....	41
<b>Table 6.2:</b> Complete ranking for Surgical Hemorrhoids Treatment Techniques (SHTTs)...	46
<b>Table 6.3:</b> Complete ranking for total Hemorrhoids Treatment Techniques (THTTs).....	49

## LIST OF ABBREVIATIONS

<b>CRH:</b>	Corticotropin Releasing Hormone
<b>CT:</b>	Computed Tomography
<b>FBP:</b>	Filtered Back Propagation
<b>FDWW:</b>	Fiber Diet with Water
<b>IR:</b>	InfraRed
<b>IRC:</b>	InfraRed Coagulation
<b>LM-OSEM:</b>	List Mode Ordered Subset Expectation Maximization
<b>MCDM:</b>	Multi-Criteria Decision Making
<b>MRI:</b>	Magnetic Resonance Imaging
<b>MSE:</b>	Mean Square Error
<b>MTF:</b>	Modulation Transfer Function
<b>NSHTTs:</b>	Nonsurgical Hemorrhoids Treatment Techniques
<b>OE:</b>	Origin Ensemble
<b>OSEM:</b>	Ordered Subset Expectation Maximization
<b>PET:</b>	Positron Emission Tomography
<b>PROMETHEE:</b>	Preference Ranking Organization Method for EnrichmentEvaluations
<b>RBL:</b>	Rubber Band Ligation
<b>RC:</b>	Resolution Compensation
<b>SHTTs:</b>	Surgical Hemorrhoids Treatment Techniques
<b>SPECT:</b>	Single Positron Emission Computed Tomography
<b>STD:</b>	Sodium Tetradecyl Sulphate
<b>THTTs:</b>	Total Hemorrhoids Treatment Techniques

## **CHAPTER 1**

### **INTRODUCTION**

Hemorrhoids are prominent and swollen veins in the anus and in the lower part of the rectum. It is the result of an effort during bowel action or as a result of heavy pressure on these veins, such as during pregnancy, as an example. Hemorrhoids is a very common disease. Until the age of 50, almost half of adults experienced itching, discomfort and bleeding that can be signs of the disease.

In most people, an improvement in hemorrhoid symptoms occurs after the use of home remedies to treat hemorrhoids and change the lifestyle.

There are four types of hemorrhoids are not usually a serious medical problem. Internal hemorrhoids are usually found in the rectum. They cannot always be seen because they are too deep and are not visible from the anus. They are not usually serious and tend to disappear on their own; External hemorrhoids are located on the anus, directly on the surface from which bowel movements emerge. They are invisible, but are sometimes seen as lumps on the surface of the anus. They Prolapsed hemorrhoids are appearing when the internal hemorrhoids swell and stick to the anus. Prolapsed hemorrhoids look like swollen red lumps or bumps outside the anus.

Thrombotic hemorrhoids mean the thrombotic hemorrhoids. Thrombophilia contains a blood clot within the hemorrhoid tissue. They may appear as lumps or swelling around the anus. Blood clots can occur in both internal and external hemorrhoids.

There are many Symptoms of hemorrhoids they are painless bleeding during bowel action. A little red blood can be seen on toilet paper or on the toilet bowl. Itching or irritation in the anus area. Pain or discomfort. Hemorrhoids visible and protruding outside the anus. Swelling (tumor) around the anus Painful or hypersensitive bump, next to the anus. Leakage (filtration) of stool

The symptoms of hemorrhoids vary depending on the location of it, for Internal Hemorrhoids Symptoms of hemorrhoids found inside the rectum. They cannot be seen or felt, usually not causing discomfort. However, stress or burning, when passing through the stool, may result in the injury of the fine outer surface of the hemorrhoids, causing bleeding. Sometimes,



especially when an effort is made, internal hemorrhoids may rush outward, that is, outside the anus. These are called "prominent hemorrhoids" or "descending hemorrhoids," and can cause pain and itching (irritability). And for External hemorrhoid which located under the skin, around the anus(American society of colon and rectal surgeons).

At this study I am going to discuss the treatment techniques of hemorrhoids with some details about the anatomical structure of the pelvic area of pelvic bones, pelvic muscles and pelvic blood vessels to understand the disease well and its causes of food dietary, scratching, itching or more pressure applied on the anus canal and blood vessels. Then, depending on some parameters that affects the treatment techniques of the disease in both types of surgical and nonsurgical I will compare these techniques of hemorrhoids treating after analyzing and ranking the parameters using one of the artificial intelligence methods calls fuzzy logic and here the fuzzy PROMETHEE ( is the fuzzy logic type which will be used and discussed in details at the method chapter) the techniques will be ordered from the best to the least preferred technique,some of these techniques needs an operation to be done and some are not, depending on the hemorrhoids phase and size.

The hemorrhoids'treatment techniques which will be discussed are:

- Fiber-diet with water
- The enema
- Ice usage
- Creams
- IR coagulation
- Rubber band ligation
- Sclerotherapy
- Stapled hemorrhoidectomy
- Laser hemorrhoid surgery
- Open or Closed hemorrhoidectomy

And the parameters to be considered at this study for ranking and analyzing the treatment techniques are Total cost, Efficiency, Recovery period, Survival rate, Practicality, Comfortability, Hospitalization time and Procedure time. Lastly the analyses and ranking will be the result of fuzzy PROMETHEE.

### **1.1. Thesis Problem**

- The statistics says that the hemorrhoids occur to each 1 of 20 persons in USA. (Hemorrhoids: FAQs for a Common Medical Condition, 2019) (Hemorrhoids: FAQs for a Common Medical Condition,2019).
- Only 1 of 3 hemorrhoids patients looking for a medication of their disease annually. (CRH medical corporation, hemorrhoid facts).
- About 50% of adult people experienced the symptoms of hemorrhoids by the age of 50 and older. (Healthline, 2016).
- The hemorrhoids survival rate for each treatment technique is different from one another as we will see in the next chapters when the treatment techniques of hemorrhoids being discussed.
- The hemorrhoids symptoms are seeming like the bowl cancer symptoms, so we must clarify the difference between both. (Healthline, 2019).
- Annually 10 million American get affected by hemorrhoids disease with prevalence of 4.4%(Sanchez, C. et al, 2011)
- People awareness of the hemorrhoid danger is low world widely, so by focusing more on this subject we may increase the awareness of people about the importance of diagnosing it before it gets into late stages and to not be shy of showing the problem; besides knowing the perfect technique to treat the disease.

### **1.2.Aims of the Study**

- To analyze and arrange the greatestpublic piles treatment techniques using fuzzy-PROMETHEE.

- To figure out the greatest required treatment techniques created by some causal parameters that regulate the superiority of treatment of the Hemorrhoids.
- To support linked people by offering the top outcome conferring to the needed characteristics of the hemorrhoid's treatment techniques.
- To gather information about the disease and spread awareness of it for the public people and communities to know the disease symptoms and best habits for it.

### **1.3. Significance of the Study**

- The outcome of this study will give the most inclusive data and evaluation about the hemorrhoid treatment techniques' parameters to literature.
- The outcomes of this study will give rapprochement with different techniques on the hemorrhoids treating options and comprehensive data of the parameters of the treats, to doctors, patients and hospitals.
- The outcomes of this study will aid sick people to discover the most active method to rise their hemorrhoids treatment ability with less pain and more comfort way.
- The outcomes of this study will help to select best treating option for the hemorrhoid.

### **1.4. Limitations of the Study**

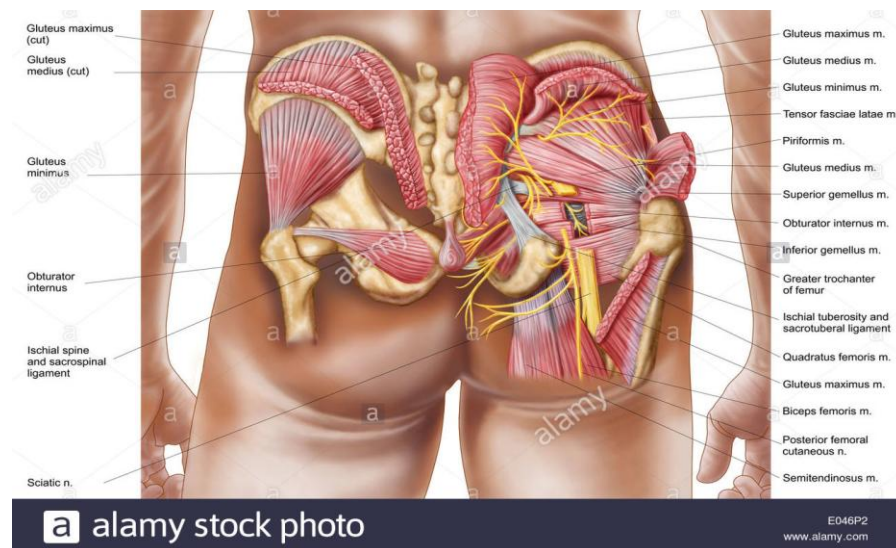
- There are many other parameters that we can use to get more specific information for each treating way, but they are not all available for all of the treatment ways so I just used the most available parameters I found.
- The treatment depends on the stage of the disease, so the information of the research depends on the middle stage where most of the treatment ways could be useful at this stage.
- The hemorrhoids' patients mostly being ashamed of giving information about their treating stages and describing their experience of this disease, so it is a little hard to make highly precise information about the treatments.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1. Anatomy of Pelvis area

Pelvis is a part of the human body that lies below the abdomen and forms an extension of it. It is a strong bone structure that transfers body weight from the spine to the lower extremities. The pelvic contents are protecting the important pelvic viscera. Pelvic bones are the lateral pelvic bones, sacrum, Coccyx that is part of the spine and forms the back wall of the human pelvis, and connected to them from the back sacrum and coccyx. From the front is separated by anti-erect. Together, these structures form a strong human pool that can contain the digestive, urinary and reproductive systems. False pelvis above the edge of the pelvis and the true pelvis is located under the edge. The pelvic wall consists of several bones and ligaments, often covered with muscles covered with fascia and peritoneum. The anterior wall is made up of the pubic bones and the pubic symphysis pubis. The posterior wall consists of the sacrum and coccyx (J W Bowerman et al, 1982).



**Figure 2.1:** Anatomy of the gluteal muscles in the human buttocks. (2014, alamy.com)

## **2.2. Pelvis Area Components**

### **2.2.1. Pelvic Bones**

#### **2.2.1.1. Sacrum Impotence:**

The sacrum consists of the residual of the sacral vertebral vertebrae that have merged to form the sacrum. The upper surface of the bone is separated with the fifth lumbar vertebra, while the lower surface is articulated with the coccyx bone. It is separated from the sides with iliac bones. The body of the first sacral vertebra protrudes forward to be the sacral protrusion which forms the true pelvic border. The anterior and posterior surface of the sacrum has four openings for the passage of the anterior and posterior sacral nerves(U. Della Croce et al, 1999).

#### **2.2.1.2. Coccyx:**

The coccyx consists of four vertebrae united together to form a triple bone, whose upper surface joins with the surface of the lower sacrum.

The lateral wall of the pelvis consists of the pelvic bone, the occlusive membrane, and the ligaments.

On the outside of the pelvis a semicircular cavity of a diameter of about 5 cm is called Acetabulum in which the head of the femur is located. The iliac bone forms 2/5 of the acetabulum, the hip is also 2/5 and the remaining 1/5 comes from the pubis.

The inner part of the iliac meets one side of the sacrum and is united in a protective ear-like joint called the auricular joint under it the acetabulum-sacrum joint, the back side of the acetabulum forward and down making a big hole called obturator foramen. The sciatic nerve passes through this hole and at the bottom of the hole, the iliac meets the hip.

The lower part of the pelvis is known as the rump; at the bottom is the sciatic hump, and a branch of the sciatic fork meets a branch of the lower pubis. The sciatic hump is the one that holds the body while sitting.

The pubic bone consists of the pubic body and two branches of bones, which meets in the pubic body and from the back the lower branch is united with the hip branch, and the upper part is involved in the formation of the acetabulum(U. Della Croce et al, 1999).

### 2.2.1.3. Obturator foramen:

It is a large hole located in the lower part of the pelvis and is bordered by parts of the pubic and rump. It is filled with an obturator membrane, which is a fibrous membrane that almost closes the opening of the obturator and remains the dominant channel for the passage of the obturator nerve and the blood vessels accompanying it when leaving the pelvis to the thigh.

### 2.2.1.4. Pelvic Base:

The base of the pelvis consists of the diaphragm that holds and supports the viscera inside the pelvis, and divides the pelvis into the pelvic foundation above it, which contains the pelvic viscera, and the perineum below it (U. Della Croce et al, 1999).

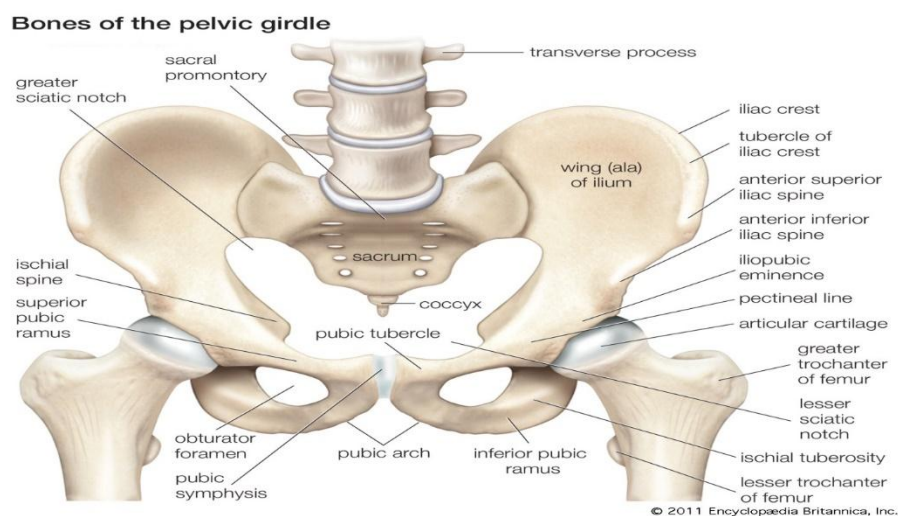


Figure 2.2: Bones of the Pelvic girdle (2007,britannica.com)

### 2.2.2. Pelvic Muscles

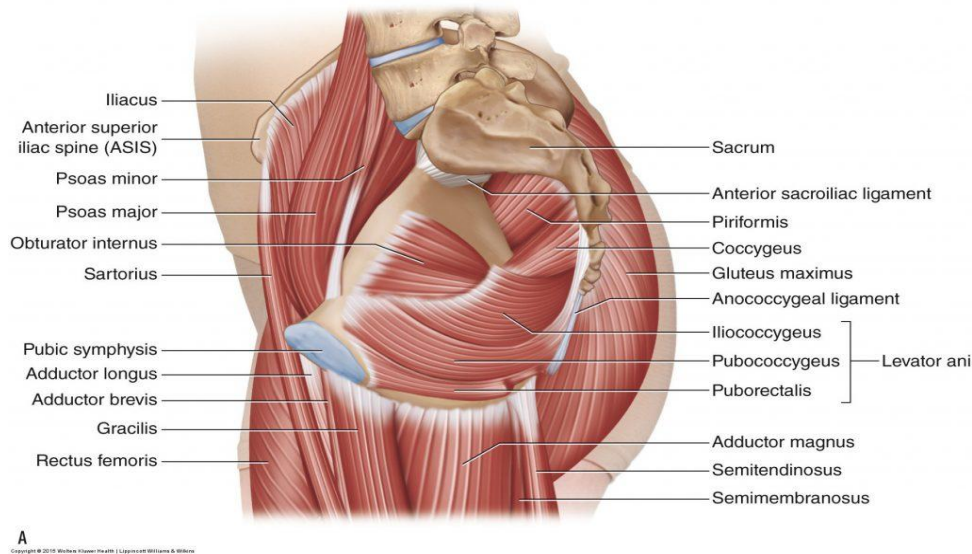
Two groups of pelvic muscles can be distinguished:

In the lumbar iliac area two muscles: Lumbar squared muscle, Lumbar iliac muscle.

When this muscle shrinks, the torso bends sideways and the pleura shrink and the pelvis is tilted. If the lumbar squeezed muscles contract together, they pull the last rib down and contribute to forced exhalation.

The iliac lumbar muscle consists of two parts: the lumbar muscle and the iliac muscle. The primary function of the iliac lumbar muscle is to keep the pelvis in its proper position, but it also forms the main flexor muscle of the thigh, which allows walking.

The second group is the pelvic muscles include the gluteal, pyramidal, twin, and quadriceps muscles. The gluteal muscles play a role in maintaining body balance and stability, while the main work of the other pelvic muscles is the execution of the femur outside(SAUVAGE LR et al, 1965).



**Figure 2.3:** Muscles of the pelvic area (2017, learnmuscles.com)

### 2.2.3. Pelvic blood vessels

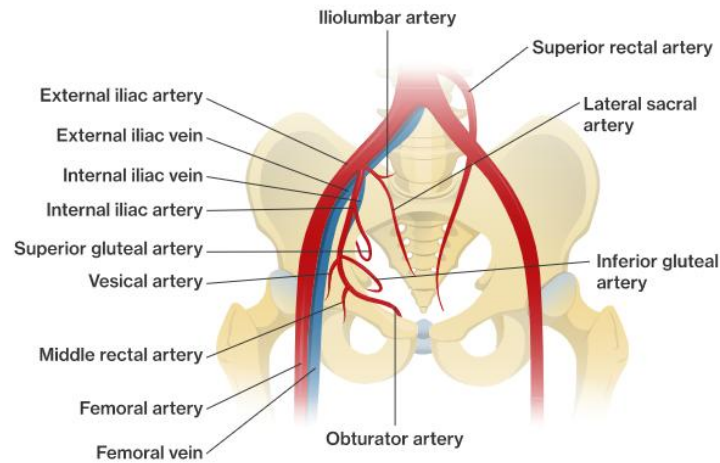
In the pelvis ends a general iliac artery on each side, in front of the sacroiliac joint, and each branch into an external and internal artery.

External iliac artery passes on the large gluteal muscle, branches into the lower hypochondrium and the iliac artery, and leaves the pelvis in the name of the femoral artery.

The arteries that feed the pelvis are: Internal artery, Upper rectal artery, ovarian artery, and Middle sacral artery.

Blood returns and accumulates in the general iliac veins, from the same arterial branches that mentioned.

The lymph also collects in the internal and external iliac nodes and the general iliac nodes(K J Taylor et al, 1985).

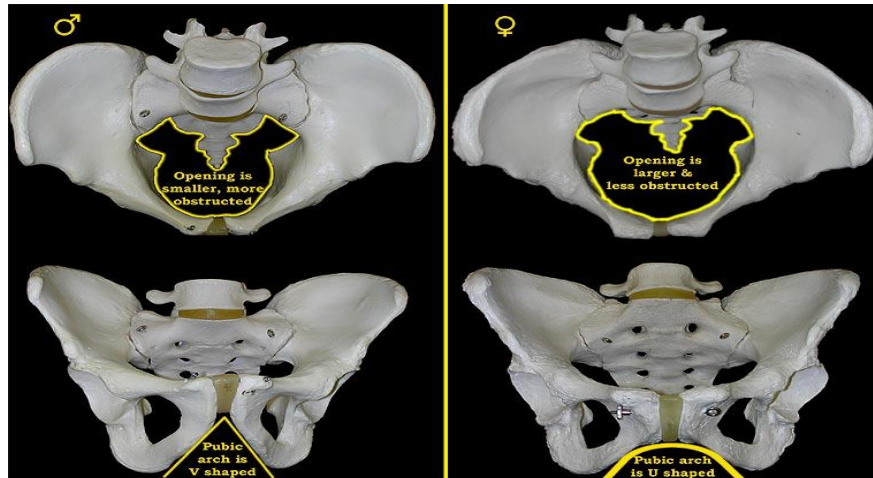


**Figure 2.4:** Blood Vessels of the Pelvis (coursehero.com)

The male pelvis differs from the woman's pelvis at several points, which is compatible with the function of pregnancy and childbirth in the female:

- The false pelvis of women shall be shallow, and deep in men.
- The shape of the entrance of the womenpelvis is oval, while its shape is heart-like in men.
- The cavity of the pelvis of the female wider, and the distance between the entrance and exit of the pelvis is short, unlike the male.
- Pelvic outlet of the female is wider than the male.
- Disability is shorter in female than male.
- Arch under the pubic be wider in the female than male.





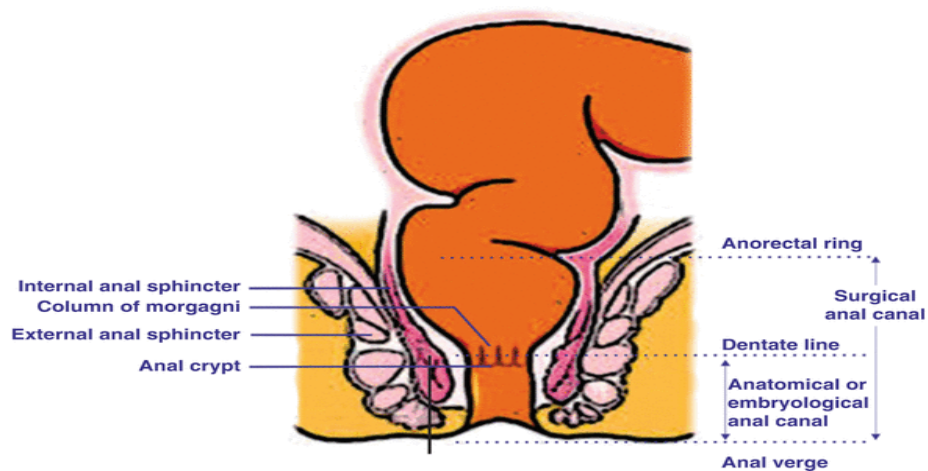
**Figure 2.5:** The Differences Between the Male and Female Pelvis (2013, radiologypics.com)

### 2.3. Medical vision of Hemorrhoids

Hemorrhoids, or inflamed veins in the anal part, signify disease of the greatest recurrent and acquainted anorectal difficulties realized in the main healing clinics' situations. There are approximations that hemorrhoids happen in up to 8/10 to 9/10 of the US population (Has PA et al, 1983) (Zainea G et al, 1994). Since the name hemorrhoids is so repeatedly misrepresented by population to define a many of other anorectal difficulties participating to perianal discomfort and blood loss, the real occurrence based on epidemiologic revisions is more in the variety of 4/10 (Zainea G et al, 1994). The occurrence of piles is equivalent among males and females, but males are more probable to pursue treatment (Gazet JC et al, 1970). The occurrence of piles also rises with oldness until the 60<sup>th</sup>, at which phase there seems to be a small weakening (Gazet JC et al, 1970) (Janicke DM et al, 1996). Pregnancy is a public disease danger factor for the growth of piles (Johanson JF et al, 1990). When properly identified, most piles can be preserved effectively in the outpatient situation by the main healing clinics. Careful medical valuation is mandatory to confirm that more important bowel illness is not wasted in the progression. This thesis reviews the existing pathogenesis, variance identifies, and suitable handling choices for piles and elucidates suggestions for surgical interference.

### 2.3.1. Anatomy and Pathophysiology

A practical knowledge of anorectal anatomy is necessary for the proper evaluation and treatment of patients with hemorrhoids.

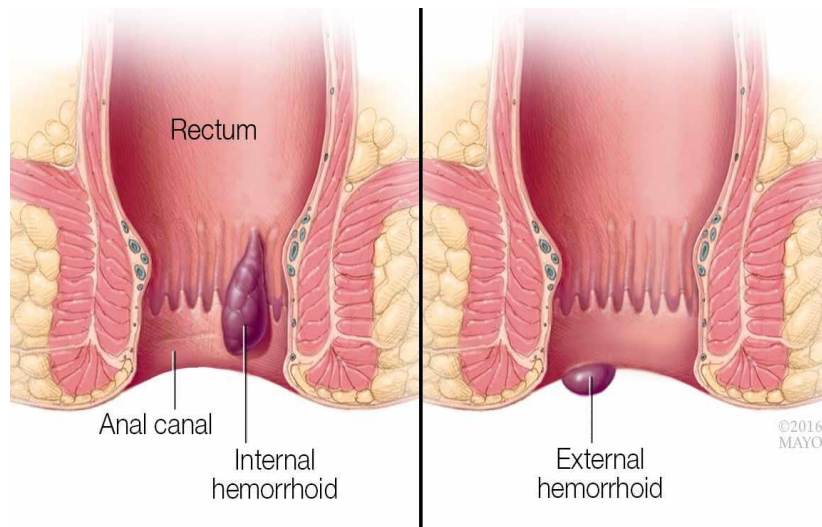


**Figure 2.6:** anatomy of anorectal area (surgical anatomy of anal canal and rectum, 2016)

(Figure 2.6) represents the classical anatomy of the anal canal and lower rectum. The most distal aspect of the anal canal at the opening is termed the anal verge. There is a circular row of glands 2 to 3 cm proximal to the anal verge that is commonly referred to as the dentate line or pectinate line. These glands secrete mucus to lubricate the anal canal. The dentate line is also the embryonic fusion site of endoderm and ectoderm. Simple columnar epithelium (anorectal mucosa) is located proximal to the dentate line in the rectum, and stratified squamous epithelium (anoderm) is located distal to the dentate line in the anal canal.

Hemorrhoids refer to the dilated versions of normal submucosal vascular beds that are located circumferentially around the anal canal and contain blood vessels, smooth muscle, and supportive connective tissue. Hemorrhoids are either internal or external and are anatomically defined based on their origin in the anal canal above or below the dentate line, respectively. It should be clarified that these definitions depend on origin, not on the location of the most distal portion of the hemorrhoids (Figure 2.6) (Medich DS et al, 1995). Internal hemorrhoids do not have somatic sensory innervation; external hemorrhoids are covered by anoderm and are

extremely sensitive. There are three areas where hemorrhoids occur more commonly: the right posterior, right anterior, and left lateral aspects of the anus. (Figure 2.7)

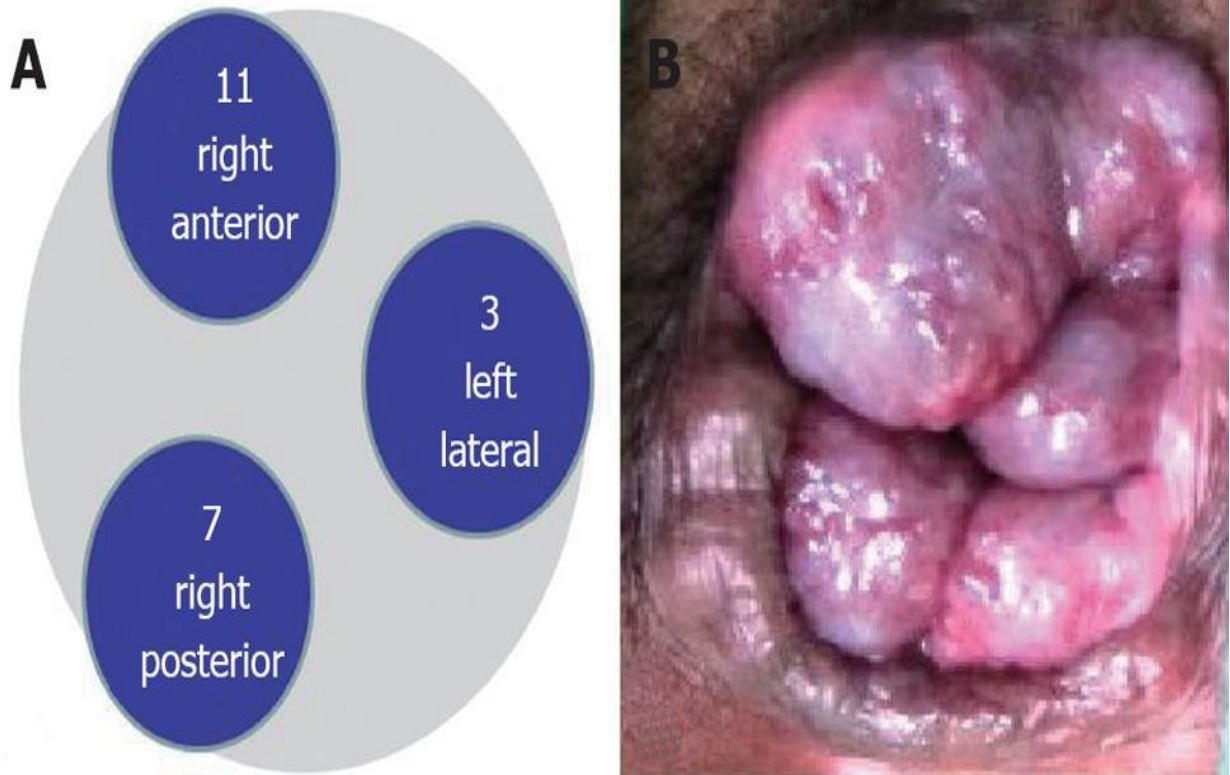


**Figure 2.7:** external and internal haemorrhoid (2016, mayoclinic.org)

### 2.3.2. Pathogenesis

The exact pathogenesis of how hemorrhoids enlarge to become symptomatic has not been fully elucidated. A consensus of clinical experience suggests that hemorrhoids are seen more frequently in patients with chronic constipation, prostate enlargement, chronic cough, and pregnancy—all conditions causing increased straining and increased intraabdominal pressure (Surrell JA, 1994). The theory explaining this is that increased straining disrupts the supporting framework of the vascular bundles, causing them to become displaced and congested (Billingham RP, 1998). In fact, an increase in the measured maximal resting anal pressure has been the most consistently reported physiologic abnormality associated with hemorrhoids. There is also thought to be a hereditary factor, possibly an underlying connective tissue disorder, because the presence of hemorrhoids has been linked with an increased likelihood of having hernias or genitourinary prolapses. Firm evidence for this is lacking, and a family history of hemorrhoids may just reflect positive bias towards seeking treatment versus a true increased incidence. Contrary to popular belief, there is no evidence that prolonged sitting or heavy lifting causes hemorrhoids, though these activities could certainly

aggravate pre-existing hemorrhoids. There are also reports of diarrhea causing hemorrhoids, especially in alcoholic patients (Hancock BD, 1992). Portal hypertension may be a contributory factor to increased venous engorgement of the anal area in such patient(Loder PB et al, 1994) (Johanson JF et al, 1994).



**Figure 2.8:** Areas where hemorrhoids occur more commonly(2012, World J Gastroenterol)

## **CHAPTER 3**

### **HEMORRHOIDS TREATMENT TECHNIQUES**

#### **3.1. NonSurgical Treatment Techniques of Hemorrhoids**

##### **3.1.1.Fiber-Diet & Water**

It is a diet-depending technique which could be very useful if the disease was discovered in an early stage so the patient can stop it before being a problem in the late stages.

Water drinking helps in many ways, drink enough water between 2 and 3 liters a day, not only to moisten our bodies but also to ease and facilitate the movement of the intestines, and drinking at least one liter of water in the early morning helps stimulate bowel movement(Fazio FW et al, 1996).

One of the most important characteristics of fiber-rich dieters is the ability to control weight. A high-fiber diet helps lose or stabilize weight in an easy way(Metamucil).

Firstly; this type of diet is saturated with low calorie foods, thus preventing over-eating.

Secondly; Foods that contain many fibers need a higher percentage of chewing and digestion, and therefore take more time when ingested and result in the consumption of food more slowly and achieve a sense of fullness and satiety before the completion of the meal

Another advantage of fiber-rich dieters is that it benefits the heart's health. When the fiber is digested by the stomach and intestines, it will move directly to the blood and thus meet the bile salts and fats and help to remove them from the bloodstream. Lower blood cholesterol, and thus protect against blockage of the heart arteries, this means to enjoy better health of the heart and blood vessels.

There are other benefits of the fiber-rich diet, which prevents problems of the digestive system, to contain the system a high proportion of fibers that increase the proportion of stool in the body and thus protection from exposure to constipation and also helps to prevent hemorrhoids and avoid the symptoms of irritable bowel syndrome

For those who are looking for a fiber-rich diet, they should choose a simple diet and increase the fiber intake to the daily meals. Fruits, whole grains, vegetables and legumes are among the most high-fiber foods. The ingredients to each meal lead to increased consumption of a large

proportion of fiber and to the numerous health benefits resulting from the application of this fiber-rich diet as indicated before(Fazio FW et al, 1996).



**Figure 3.1:** some high-fiber foods (2019, [truweight.in/blog/nutrition](https://truweight.in/blog/nutrition))

### **3.1.2. The Hemorrhoids Enema**

This technique also will help the patient who discovered the disease in its earlier stages along with the fiber-diet and water, also it could be very useful in the late stages in relive symptoms and the patient may ask to use it before making a surgery.

The enema is a procedure that is used to help stimulate bowel movement and relieve constipation. And it is considering as the most common fluid to treat constipation or gastrointestinal cleansing. Other types of enemas are used to clean the colon and diagnose colorectal cancer. This technique is old and has been used to relieve a number of diseases from fever to intestinal worms(National institute of diabetes and digestive and kidney disease).

Preparation for enema: The patient may need to fast of food and drink or follow certain dietary instructions in the days leading up to the enema.Instructions may vary, depending on physician and personal health needs.If the enema procedure is at home, be sure that all the equipment being used has been sterilized and the presence of a lubricant.Careful attention to the method of preparation of the solution for enema is necessary.To relieve pressure in the colon it is recommended to empty the bladder before starting the enema.The patient may need to place a towel or cloth in the area between the bathtub and the toilet, in case the fluid leaks from the intestine when the colon is discharged.

It is important to measure the syringe tube so that the tube is not inserted more than 4 inches in the rectum.

Uses of enemas: Constipation is one of the most common digestive conditions. The patient becomes constipated when the colon is unable to get rid of waste through the rectum. People with this condition perform less than 3 times a week. Often, mild constipation occurs when you do not eat fiber or drink enough water regularly. The enema is used to clean the lower intestine. This solution is a last resort to treat constipation (Krokowicz L et al, 2014).



**Figure 3.2:** some enema shapes (barewalls.com)

If diet and exercise is not enough to keep a normal bowel movement, your doctor may recommend using a laxative before attempting to use enema. In some cases, laxatives are used before the enema is used to improve the flow of waste. Enemas can also be used before medical tests for the colon. Your doctor may require an enema before X-rays of the colon to detect benign tumors so that a clearer picture can be obtained. Anal injections can also be performed before the colonoscopy. The purpose of the enema is to clean the colon gently. Enema may also be recommended before the colonoscopy or other medical examinations. It is also hardly needed to treat the pain that happens during the patient having hemorrhoids in the end of the flow path of waste products. Treat constipation, fatigue, headache, and back pain that can be eliminated after enema use. During the enema a solution consisting of water and a small concentration of stool filter, whether baking soda or apple cider vinegar is used to

stimulate the movement of large intestine. An enema should stimulate the intestine to expel the waste quickly and get rid of the solution.

**Saltwater Solution:** A saline solution is used in the enema where it is placed in a bag on one side of the tube. The other limited part is placed in the rectum to bring the solution to the colon properly. The following guidelines should be followed: The syringe bag is filled with solution, using warm water. Be sure to close the clamp. And make sure to get rid of the bubbles, which increase the symptoms of the colon. The bag is suspended in the bathtub so that it can be accessed while sleeping on the left side. The end of the tube should be lubricated to make the tube more comfortable for the patient; the entry in the rectum is no more than 4 inches. The anus is pushed to insert the tube to make it more comfortable. The patient waits for the liquid to enter the rectum and observe the bag until it becomes empty. Remove the tube from the rectum slowly. The patient may feel more likely to use the bathroom ('evacuation') immediately. If the enema is used for disinfection, the patient must stand carefully and move to the toilet (Medical Dictionary, 2018).

### **3.1.3. Hemorrhoids treatment using Ice**

Ice packs or cold compresses can be placed on the anus to relieve swelling for 15 minutes at a time. For large, painful hemorrhoids, snow can be a very effective treatment. Always wrap the ice in a cloth or paper towel. How does snow relieve symptoms of hemorrhoids? Ice therapy, also known as cryotherapy, works by reducing blood flow to a particular area, which can greatly reduce inflammation and swelling that causes pain. It can temporarily reduce nerve activity, which can also relieve pain, which helps in treating and alleviating the symptoms of painful hemorrhoids. There are a number of different ways to apply cold treatment or snow on the affected area, and treatment options include: rubber ice packs. Ice-cream frozen. Massage with ice cubes. Some household solutions such as moistening and freezing the towel can be done for 15 minutes and then used on the affected area, or ice cubes placed in a plastic bag and used. Symptoms of hemorrhoids, their causes, types and methods of treatment Important warnings when using ice locally for treatment People with sensory disorders that prevent them from feeling certain sensations, should not use cold treatment with snow at home because they



may not be able to feel harm if it occurs, Diabetes. Cold treatment should not be used in the case of impaired circulation. Cold treatment applied for too long or intensively may damage the skin, tissue or nerve damage. Consult your doctor before using cold treatment if you have heart disease or blood vessels. If your hemorrhoids bleed or cause severe pain, do not try any home remedies; contact your doctor for advice and recommendations on treatment. Snow use for hemorrhoids is not intended to replace medical treatment(healthline, 2017).



**Figure 3.3:** freezing bags for treating Hemorrhoids (2019, ebay.com)

### **3.1.4.Many creams**

Ointments or suppositories can be used to relieve hemorrhoids without the need for a prescription, but they should be used every time for only 5 to 7 days because they can cause discomfort to the sensitive skin if used for a long time. Steroidal creams: When there is acute inflammation around the anus, the doctor may prescribe steroids containing stimulants, and preferably not used for more than about a week because it can make the skin less thick and irritating. Analgesics Paracetamol can help relieve the pain of hemorrhoids, and when excessive bleeding is necessary, avoid using non-steroidal anti-inflammatory drugs such as ibuprofen, because it may cause bleeding of the rectum worse, and keep away from painkillers that cause constipation such as codeine analgesics, It is possible to use products containing local anesthetic to treat hemorrhoids without the need for a prescription which should be used for only a few days as they make the skin around the back way more sensitive. Laxatives: Laxatives help to empty the intestines, so it is possible to prescribe a laxative in the case of constipation(mayo clinic, 2019).



**Figure 3.4:** Walgreens Hemorrhoidal Pain Relief Cream (2011, walgreens.com)

Another main branch of creams using for hemorrhoids treatment are the creams containing a chemical composition calls hydrocortisone.

Hydrocortisone is chemically similar to the cortisol hormone produced by the adrenal glands, and one of its most important uses is replacing natural hormones in the case of adrenal insufficiency.

The main use of this medicine is to treat a variety of infections and allergies. When used topically, it reduces immediate inflammation of the skin, eyes and outer ear. It is taken orally, to treat asthma, inflammatory diseases of the intestine, allergic reactions and rheumatism. When injected directly into the joint, it relieves pain and stiffness.

One of its most important uses is to prevent serious asthma attacks. However, excessive use of hydrocortisone creams may cause permanent skin atrophy. When taking hydrocortisone orally, for a long time, and in high doses, it can lead to serious side effects and suppressing the immune system. It is advised to avoid exposure to tuberculosis and varicella patients, and to avoid receiving live virus vaccines(American Society of Health-System Pharmacists, 2015).

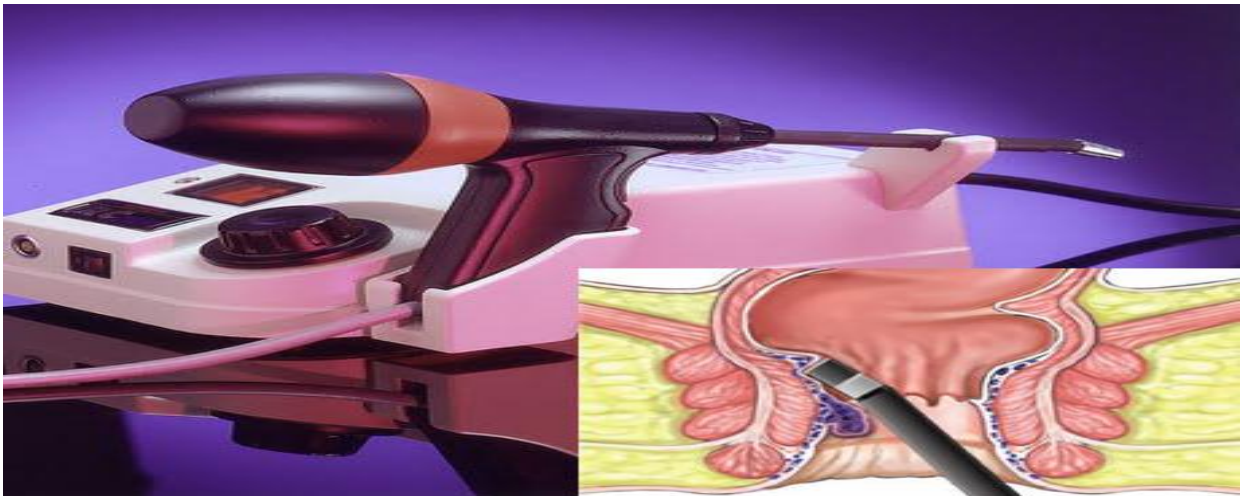
### **3.1.5. Infrared coagulation**

The infrared coagulation IRC is a procedure to treat the internal hemorrhoids “as there are internal and external types” without needing to a surgery, but it can be applied to the earlier stages I and II, by the way it is so effective and its accuracy is around 70%. The procedure is occurs by using an infrared source as a heat source waiting it to reach the recommended heat degree the plugging it inside within the head of a little tube to not discomforting the patient

during the procedure, then a sharps of IR will be sending by the main device to the tube head as mentioned to give the heat which will then affects the blood vessels which are responsible of deliver the blood to hemorrhoids' cells area, then these vessels will be blocked by heat and after a while when the hemorrhoids cells being blocked from the blood which carries the oxygen and nutrition they will die and drop out of the rectum.

There is no special diet that must be made before this procedure, but the patient might be recommended to use an enema for wetting the path and make the procedure easier and lesser pain for him. After the procedure by almost one hour the patients with sensation at that area because of IR or heat will not feel anything and after a few days the patient will be able to make any kind of activity that he want to do, but the normal and easy actions like driving the car to and from the hospital are allowed.

Some patients may bleed after the procedure or even feels discomfort but all of these syndromes will be gradually decreased within 10 days (NorthShore University Health System).



**Figure 3.5:** IRC device and procedure place (hemorrhoidtreatmentnyc.com)

### **3.1.5.1. Advantages and Disadvantages of IR coagulation**

- The procedure is completely painless and non-bloody; therefore, it can be performed without anesthesia. With a low pain threshold, local anesthesia is allowed.
- It takes less than a quarter of an hour to remove a contract.
- The patient does not need to go to the hospital for treatment.
- Laser treatment does not require any special and long preparation.
- After the operation, there are no scars on the body.
- There is no long rehabilitation.
- Complications are rare.
- The operation is not contraindicated even in the presence of fistula, anal fissures and inflammatory processes in the anal area.

Along with many advantages, the disadvantages of IR coagulation are:

- The possibility of incomplete removal of large hemorrhoid nodes in one sitting. In these cases, additional procedures are required,
- Very high cost, which not every patient can afford.

### **3.1.6. Rubber band ligation**

The rubber band ligation is a simple nonsurgical treatment operation and like the IRC it is just used being used for the internal hemorrhoids, but unlike it by that it is better be used at the fourth stage hemorrhoids.

This procedure can be done by the doctor's office for one to two hemorrhoids each time and more than that if it is done by an operation room with a full body anesthesia and between each procedure and the other there must be a rest duration of 4 to 6 weeks after the first procedure.

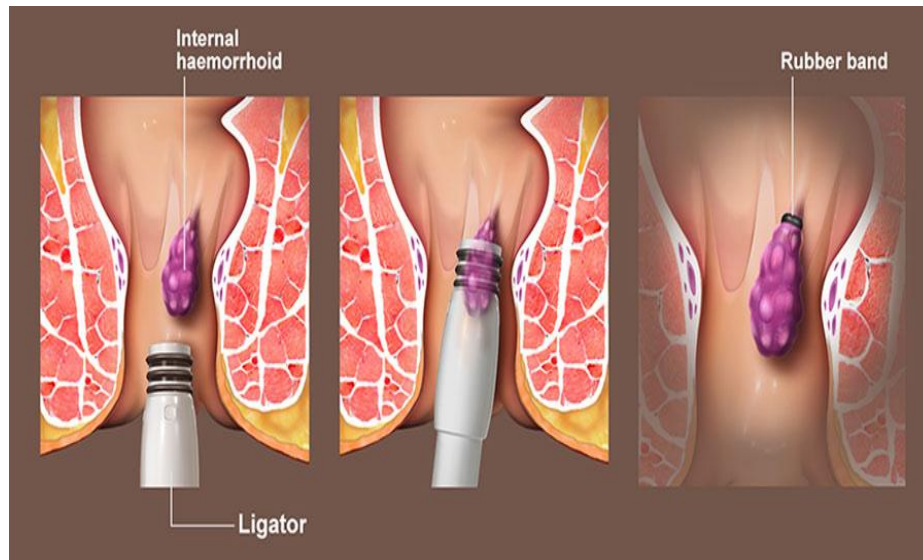
It can make by a small tube holding a metal head upon it which called the ligator which in turn holds the rubber at its top; before if inserting this tube a device called anoscope that getting inside and grasping the hemorrhoids toward of its self the theligator pushing inside and holding the upper side of the hemorrhoids by a rubber well tied.

The purpose of this procedure is to gradually decreasing the nutrients that arriving the hemorrhoids by the blood vessels, but the rubber must not be very tied and letting it in a little

resting position and if the patient felt a strong pain the doctor can inject some drugs toward the hemorrhoids site to little untighten the rubber.

After one week of the procedure the hemorrhoids will be died and fall down by itself.

After the procedure most of patients returning to their normal daily activities almost immediately, but some patients need to get rest from 2 to 3 days after procedure (British Columbia, 2018).



**Figure 3.6:** Rubber band ligation procedure way (greater Houston gastroenterology)

### 3.1.7. Sclerotherapy

It is a very simple procedure that can be done by injecting a substance using a simply sterilized syringe into the hemorrhoid body that then getting hardens when the blood inside of it collapsing and sticking together then being clotted, this happens because of the injected solution which usually a salt solution is called sodium tetradecyl sulphate STD.

This procedure is the easiest nonsurgical procedure and usually using in the phases 1, 2 and sometimes with phase 3 but it less effective than the other ways.

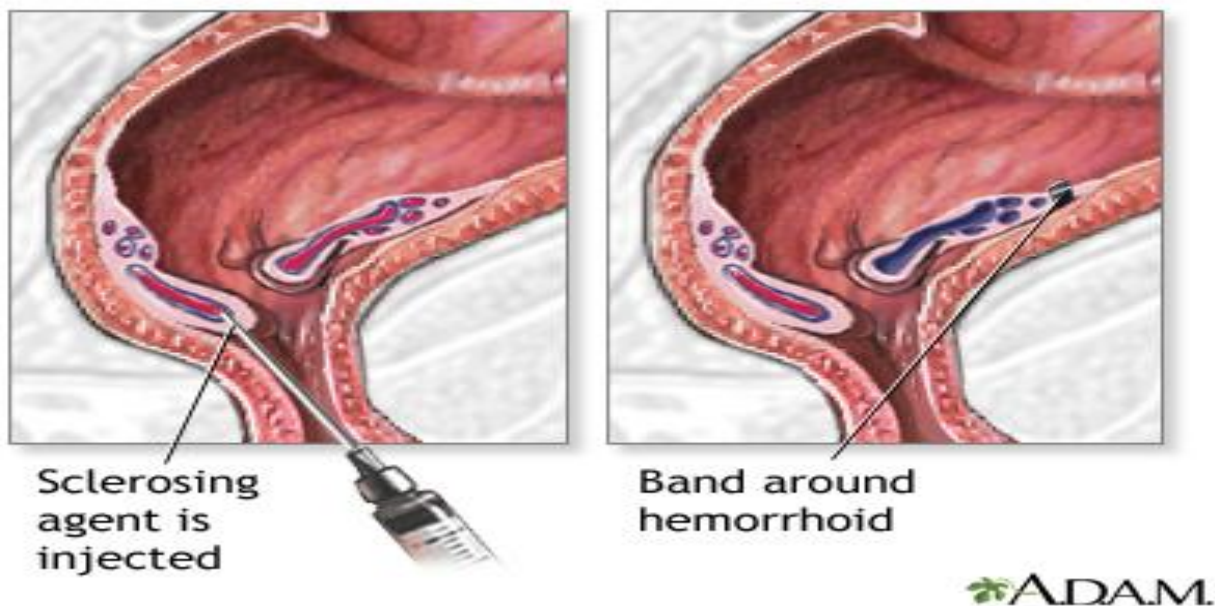
The patient may need to use the enema because of the procedure to make it easier by making the colon empty.

Sclerotherapy is a medical intervention used to treat blood vessels or deformities, as well as those in the lymphatic system. The blood vessels are injected with medical material that

causes them to shrink. Used for children and young people with vascular diseases and lymphatic abnormalities. Sclerotherapy is often used in adults to treat varicose veins, telangiectasia and hemorrhoid.

This procedure uses one of the following methods: surgical intervention, radio frequency, laser ablation. In ultrasound-guided sclerosis, ultrasound is used to visualize the primary vein so that the doctor can present and monitor the injection.

Ultrasound-guided treatment is used to show the underlying veins so that the doctor can perform and monitor the injection. Ultrasound-guided sclerotherapy is usually performed after the diagnosis of vein abnormalities using ultrasound multiplier. Ultrasound-guided sclerotherapy using microfoamers has been found to be effective in controlling retrograde blood flow in the femoral and saphenoid saphenous conductors. However, some researchers believe that sclerotherapy is not suitable for the treatment of veins affected by retrograde flow, whether the veins of the small and large net connector or veins with axial retrograde flow (Drugs, 2019).

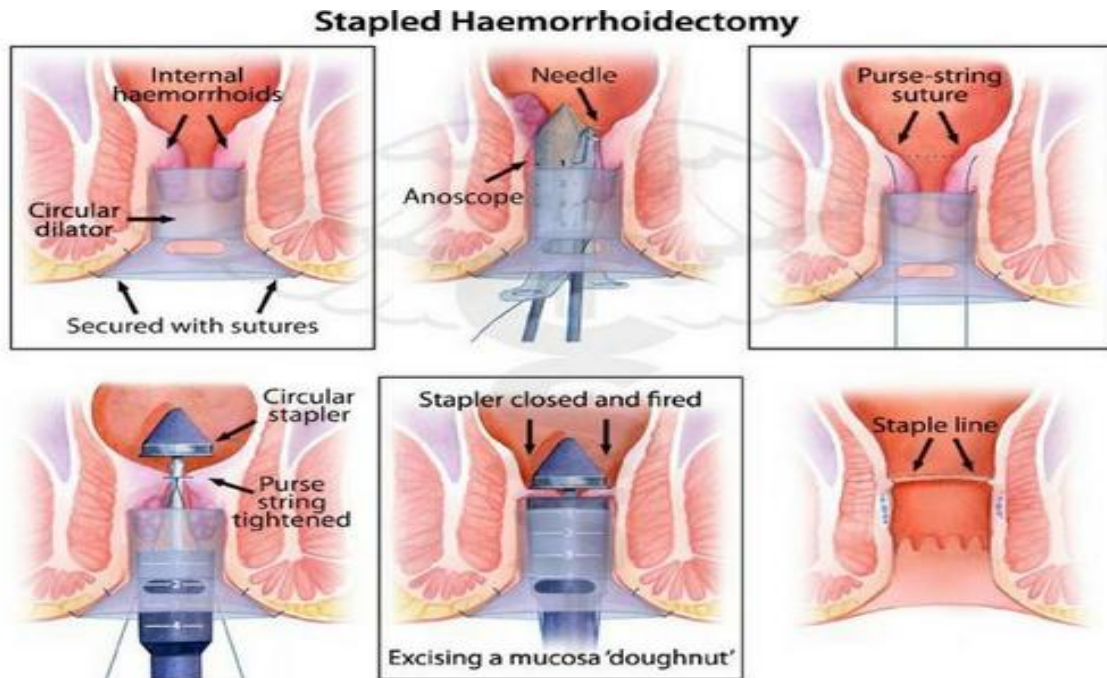


**Figure 3.7:** Sclerotherapy treatment (2017, medlineplus.gov)

## **3.2. Surgical Treatment Techniques of Hemorrhoids**

### **3.2.1. Stapled Hemorrhoidectomy**

The process of stapling hemorrhoids: stapling of hemorrhoids is a type of operation of hemorrhoids, and does not mean to cut and remove the hemorrhoid; rather it is stuck in place, by inserting a hollow circular tube in the anal canal. This tube contains a long surgical thread that enters the two terminals into the anus; the stapler is then placed under the hollow tube to pull the ends of the tube down. With the pull of the flap, the tissue that supports the hemorrhoids is pulled back. The hemorrhoids are returned to their previous position within the rectal canal before the incision. The stapler is used to treat second phase hemorrhoids, when the hemorrhoids is dangling inside the anus because of the bowel movement, while external hemorrhoids are usually addressed through hemorrhoidectomy process. The work of stapling depends on the arterial vasectomy that passes within the enlarged hemorrhoidal tissue and thus reduces the blood flow to the blood vessels in the hemorrhoid, which reduces its size. After the tissue is healed, a scar tissue forms in the normal location of the anus, in order to heal; the wound is only needed for food. After a while, the staple thread used in the process falls through the stool until the patient himself does not notice it. Side effects of the hemorrhoid stapling operation: Although hemorrhoid surgery has been successes most of times; it is a surgical operation with complications and side effects. These effects include bleeding or blood clotting after one week of the procedure. Infection, causing abscess or pus in the area, treated with some antibiotics. Urinary retention, a difficulty in the discharge of urine due to the effect of anesthesia on the nerves of the pelvic area. Anal fistula is a small canal developing between the surface of the anal and anal canal. Stenosis in the anal canal, the most dangerous effects because it causes pain in the process of defecation or even when there is no defecation process, and treated with drugs or surgery in advanced cases (Jay W., 2018).



**Figure 3.8:** Staped Hemorrhoids operation (2012, indiamart.com)

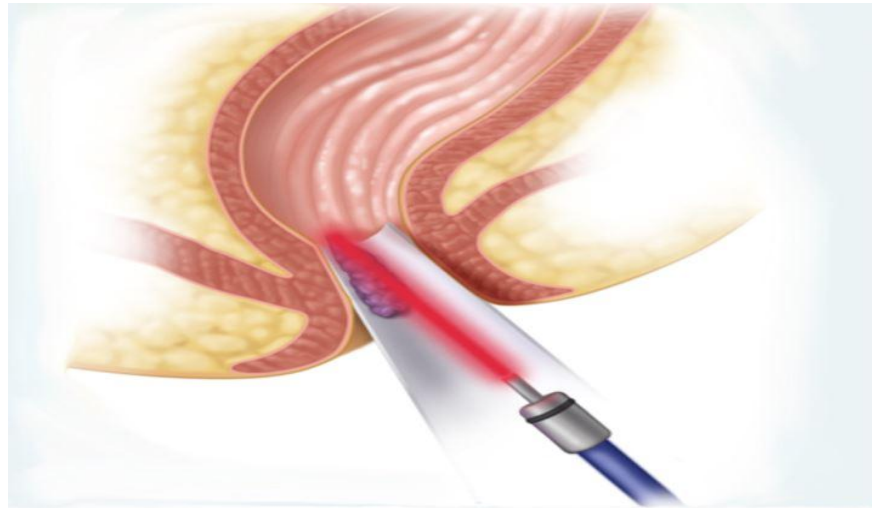
### 3.2.2. Laser hemorrhoid surgery (Doppler technique)

Is the duration of the operation. The procedure lasts between 30 minutes and 40 minutes, depending on the patient's condition and degree of injury, the availability of modern equipment and the skill and experience of the surgeon. Laser hemorrhoids also allow the patient to eat after completion of the operation not more than 3 hours, and then the patient can go to his house on the same day to exercise his life naturally from the next day. On the other hand, the process is very expensive compared to all other hemorrhoids.

The idea of laser hemorrhoids is limited to releasing rays in the form of heat energy that sends high vibrations like a surgical scalpel to dilute the surrounding tissue. The process is performed by introducing a probe into the varicose veins and veins to be heated and thus steaming the hemorrhoids using the invisible laser beam. After that, the electricity is used to stop the blood from reaching the hemorrhoids and thus shrink it, which reduces the chances of bleeding and the patient's healing speed. Despite all these previous advantages, laser hemorrhage is not yet sufficiently widespread in around the world or specially third world countries. This is due to the high costs of medical devices used in the operation, the lack of



practice by physicians for such operations, and the high cost of operation compared to operations the other scattered and which come with satisfactory results(Giamundo P, 2012).



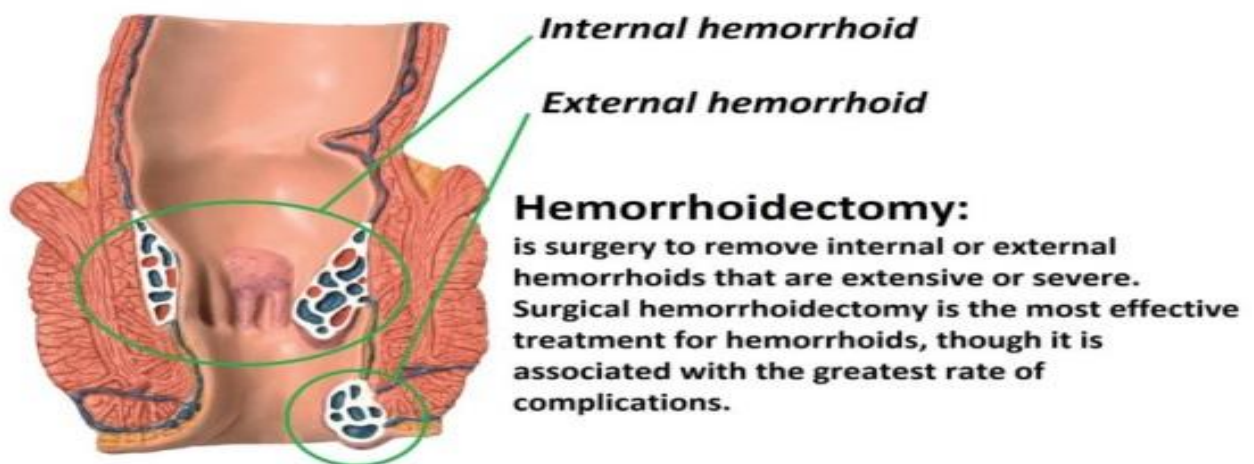
**Figure 3.9:** Laser operation for hemorrhoid (2015, laser hemorrhoid center)

### **3.2.3.Open or Closed Hemorrhoidectomy**

Hemorrhoidectomy is applied for big exterior hemorrhoids and inner hemorrhoids that have deteriorated or affected difficulties and are unresponsive to non-surgical controlling. This process typically occurs in the hospital. The patient and his specialist will choose the best anesthesia to apply through surgery. Options comprise: Common anesthesia, which lays the patient into a deep sleep during operation. Local anesthesia, which includes a drug that dips his body from abdomen to waist, is transported by a fluid in his back. And regional anesthesia that fills the anus and rectum only. He may also be given a calming to help him ease during the operation if he is receiving local or regional anesthesia. Once anesthesia becomes active, the specialist will censor the large hemorrhoids. When the process is finished, he will be taken to the retrieval chamber for a short-term period of remark. Once the therapeutic crew determines that his vital marks are constant, he will be able to coming back home. Discomfort and contamination are the most general dangers related with this sort of operation. It is considering as a normal surgery type and from the earlier operations in this field, the doctors are using their simple and offered tools which can be found almost anywhere, so it is the most

common operation world widely but it has the higher rate of danger or risk on the patient and needs to take a rest in bed from two to four weeks after the operation but normally the patient can eat and make a small moves in around 3 hours after operation. Any bleeding and other effects will be noticed by the doctors before he leaving the hospital and they will provide him a medicine description of creams or belts to decrease the pain as much as possible.

The patient may need to visit the major specialist who made the operation other times if the effects didn't disappear totally after the prescribed period (Debra Stang, 2017).



**Figure 3.10:** Hemorrhoidectomy short explanation (2019, hemorrhoids.qsota.com)

### 3.3. Literature Review

Literature evaluations exhibit many researchers who have performed their research via the use of multi-criteria decision making (MCDM) strategies and making use of this approach in various areas of study which include chemistry, medicine, social research and engineering. Concerning cancer treatment's region of study, Ozsahin et al. (2017) designed a lookup that aimed at reading and evaluating the selections of most cancers' treatment. They used fuzzy PROMETHEE and applied the multi-criteria decision-making techniques on exclusive choice of most cancers' treatment. They compared six most important cancer therapy techniques: chemotherapy, radiation therapy, hadron therapy, immune-therapy, hormone remedy and surgery. The contrast was once frequently conducted primarily based on some predominant factors that impact the effects of selected therapy technique. This consists of the cost of treatment, the duration of treatment, the likely aspect consequences and the survival rate. Their conclusion showed that hadron therapy, which is characterized by using the perfect survival price and the shortest therapy time and have a net-flow fee of 0.4931, was the most fantastic cure technique. Further, their conclusion showed that the surgery, which is characterized through the easiest treatment fee and has a net go with the flow value of 0.5262, would be the most favored technique among the hospitals.

Concerning the contrast of the most frequent nuclear medication imaging devices, Ozsahin et al. (2017) conducted a research that aimed at studying and comparing these devices through using a multi-criteria decision-making technique. They studied the Positron Emission Tomography (PET), Single Positron Emission Computed Tomography (SPECT), PET / CT, SPECT / CT and PET / MRI. They made a stable contrast between these gadgets primarily based on the remedy cost, average radiation dose, specificity of the device, spatial resolution, sensitivity, electricity decision and average scan time. Further, they made a concrete analysis by using the usage of Yager Index in order to discover the magnitude of the triangular fuzzy numbers. Finally, they developed a Visual PROMETHEE Decision Lab Program with the Gaussian desire function in order to attain their result. Their conclusion showed that the most efficient and encouraged think about device, in light of the parameter used, is the PET with a net-flow of 0.0005.

With regards to the picture building algorithms strategies used in nuclear medicine, Ozsahin et al. (2018) carried out a lookup with the aid of using the technique of fuzzy PROMETHEE. They in contrast the Ordered Subset Expectation Maximization (OSEM), Origin Ensemble (OE), List Mode-OSEM (LM-OSEM) and Filtered Back Propagation (FBP). Their find out about aimed at figuring out the most positive technique that produces a greater satisfactory of picture with the most indispensable characteristic in nuclear imaging. They constructed their research on the following parameters: The Mean Square Error (MSE), Variance, Modulation Transfer Function (MTF), Run Time, Uniformity, Resolution Compensation (RC) and Bias. Their conclusion confirmed that the FBP, with a net-flow of 0.0031, is the most efficient algorithm in phrases of the first-class of images.

Concerning x-ray primarily based clinical imaging devices, Ozsahin et al. (2018) used Fuzzy Preference Ranking Method in order to enrich the critiques of these devices. These gadgets include the traditional x-ray machine, angiography, Computed Tomography (CT), fluoroscopy and mammography. Their lookup aimed frequently at analyzing the efficiency, potentiality and barriers of each single device by way of using Fuzzy PROMETHEE. They used the specificity, sensitivity, radiation dose, price of cure and cost of laptop as the essential parameters to do their study. They did their evaluation via taking the influences of gadgets on both patient and hospital. Additionally, they used Yager index to the traditional x-ray machine, with a internet go with the flow of 0.0017, is the most appropriate imaging device regardless of the fee of computer parameter. However, the mammography, with a net waft of 0.0015, is the most suitable one when taking the desktop cot into consideration.

In mild of reading breast best cancers treatment techniques, Ozsahin and Ozsahin (2018) studied chemotherapy, surgery, radiotherapy, and hormone therapy treatment strategies through the use of a fuzzy PROMETHEE. Their learn about aimed normally at examining and rating the most suitable cure approach via reading the following parameters: survival rate, cure cost, cure time and facet effects. Further, they used Yager index in order to become aware of the triangular fuzzy numbers and calculate the weight of every criterion. Their conclusion confirmed that surgery is the most preferable cure approach amongst patients with a net flow of 0.5156.

## CHAPTER 4

### PARAMETERS

**Table 4.1:** Hemorrhoids Treatment Techniques and Their Detailed Parameters

<b>Surgical</b>	<b>Total Cost</b>	<b>Efficiency</b>	<b>Recovery Period</b>	<b>Survival Rate</b>	<b>Practicality</b>	<b>Comfortability</b>	<b>Hospitalization Time</b>	<b>Procedure Time</b>
Stapled Hemorrhoidectomy	1183\$	94%	4-30 days	67%	Medium	Medium	1-3 Days	30 min
Laser Hemorrhoid surgery	9000-12000\$	80%	14-21 days	99%	Low	High	1 day	30-40 min
Open or Closed Hemorrhoidectomy	2911-5384\$	86%	7-14 days	86.6%	High	Medium	6-12hours	less than hour
<b>Non-surgical</b>								
Fiber-Diet with Water	about 3\$/session	Medium	not detected	50%	High	High	no hospitalization	No procedure
The Enema	65\$/tube	Low	not detected	not detected	Medium	Medium	no hospitalization	5 min
Hemorrhoids treatment using Ice	13\$/2packs	High	not detected	not detected	High	High	no hospitalization	15 min
Creams	average of 20\$/tube	Medium	not detected	not detected	High	Medium	no hospitalization	1 min
Infrared coagulation	1600-2000\$	67-96%	7-10 days	67% - 96%	High	High	1 day	5-10 min
Rubber band ligation	500-1500\$	61.4-74.6%	1-2 weeks	60% - 80%	High	High	2-3 days	less than an hour
Sclerotherapy	336-429\$	84%	2 weeks	94%	Medium	High	no hospitalization	15-30 min

#### 4.1. Total Cost

The total cost of Hemorrhoids treatment technologies varies from 3\$/session (Fiber-Diet with water) until 12000\$ (Laser Hemorrhoid surgery), this cost differs according to the used technique, used device, operation type (if it needed an operation), and the place of treatment.

## **4.2. Efficiency**

The efficiency of treatment technique is being calculated by percent in the operational options and by the observed effect in the non-operational options. The Hemorrhoids Treatment Techniques shows an efficiency between 61.4% and 96% for the operational options and between HIGH and LOW for the non-operational options, because the lastly mentioned options are used in the early detected stage of the disease so, no many statistics observed to be calculated as a percent efficient.

## **4.3. Recovery Period**

The recovery period calculating the time for the patient to be recovered after the treatment being applied, it is calculated by number of days the patient needed to start living normally with no pain, itching or other after cure complications. The recovery period for Hemorrhoids treatment techniques is varied between 4 and 30 days; the non-operational treats (fiber-diet with water, the enema, hemorrhoids treatment using ice and Creams) are not detected for this parameter because it differs according to the stage of piles the patient has and they are not always curing the disease even when be used for a long time for some cases.

## **4.4. Survival Rate**

The survival rate from a treated disease is being measured by the percent of people who are totally cured after using some kind of treatment for the disease. The survival rate for Hemorrhoids treatment techniques is varied between 50% (for fiber-diet with water which is as a non-operational option is considered to have a high survival rate) and 99%. The non-operational treatment options other than the fiber-diet with water have not detected survival rates for the same reasons mentioned in section **4.3**.

## **4.5. Practicality**

The practicality of treatment here means how easy and available this technique to be applied for any patient world-widely, so more advanced or high priced means a low practicality way; it is also being measured by the HIGH, MEDIUM and LOW. The Hemorrhoids treatment techniques have many of high practicality options which are 6 out of 10 treatment techniques; and 1 low practical technique (Laser Hemorrhoid surgery).

#### **4.6. Comfortability**

The comfortability measures how comfort the patient is immediately after applying a treatment technique. It is measured for Hemorrhoids treatment techniques by HIGH, MEDIUM and LOW. There are zero LOW comfortable options in Hemorrhoids treatment techniques.

#### **4.7. Hospitalization Time**

The hospitalization time measures the time that the patient needed to stay and rest at the hospital by the order of the doctor to be observed, checked and served until he is able to leave with the lowest chance of any harm and when the postoperative complications are gone. It is between 0 (no hospitalization) and 3 days for the Hemorrhoids treatment techniques. The non-operational techniques have no hospitalization time because they are applied at home; also, the sclerotherapy has no hospitalization time because it has no postoperative complications.

#### **4.8. Procedure Time**

Procedure time is the time needed until fully apply the technique of the treatment for the patient. It is differing from 0 (no procedure) until less than an hour for the Hemorrhoids treatment techniques. Fiber-diet with water has no procedure time because it is such a habit to be doing along the day until the patient gets well someday. The other non-operational techniques just measured the time to apply these techniques by the patient or the assistant oh him.

## **CHAPTER 5**

### **METHODS**

#### **5.1. Fuzzy Logic**

It is important to point out the difference between fuzzy logic and probability, since the probability theory before Fuzzy Logic was the only mathematically well-developed theory to deal with Uncertainty. Despite the great success of this theory in many applications, it was limited to one type of uncertainty. The theory of fuzzy groups has witnessed a great development to become a prominent practical field called fuzzy systems or fuzzy logic.

Both theories operate under the same numerical range and both have similar values. 0 represents error (inorganic), and 1 represents validity (full membership). However, there is a difference between these two sentences:(There is a 50% chance that  $\gamma$  is low (in the probabilistic language, whereas in the fuzzy language) corresponds to the membership degree  $\gamma$  within the low group is 50.0.) The moral difference varies, at first sight it is assumed that  $\gamma$  is in the group low or not within it, i.e. We have a 50% chance of knowing which group is low, on the contrary, the fuzzy term assumes that  $\gamma$  is (more or less) within the low group, or in another term that matches the value of 50.0 (Klir,G.J, 1997).

#### **5.2. Multicriteria Decision-Making (MCDM)**

Multiple Criteria Decision Making (MCDM) is a method to evaluate various available options, according to decision criteria and also to assign importance weightings (Very High, Important, Medium, Low, Very Low) to the criteria. Upon this, according to the assigned importance weightings, the best option can be determined and makes the parameter a favorable (maximal advantage) or unfavorable (minimal concession) choice for a specific application.

#### **5.3. Fuzzy PROMETHEE methods**

These methods allow confronting multiple allegations, where A is for accidents, in this case the basic data of the problem are in an evaluation table as follows:



**Table 5.1:** Information table for PROMETHEE method

<b>FK(.)</b>	...	<b>Fj(.)</b>	...	<b>F2(.)</b>	<b>F1(.)</b>	
$f_k(a_1)$	...	$f_j(a_1)$	...	$f_2(a_1)$	$f_1(a_1)$	<b>a<sub>1</sub></b>
$f_k(a_2)$	...	$f_j(a_2)$	...	$f_2(a_2)$	$f_1(a_2)$	<b>a<sub>2</sub></b>
.	...	.	...	.	.	.
.	...	.	...	.	.	.
.	...	.	...	.	.	.
$f_k(a_i)$	...	$f_j(a_i)$	...	$f_2(a_i)$	$f_1(a_i)$	<b>a<sub>i</sub></b>
.	...	.	...	.	.	.
.	...	.	...	.	.	.
$f_k(a_n)$	...	$f_j(a_n)$	...	$f_2(a_n)$	$f_1(a_n)$	<b>a<sub>n</sub></b>

Additional information in this way consists of two types of information

- Information within the standard: means information related to the standard, which is through which the information and the characteristics of each of them are not included.
- Information outside the standard: This is intended as information that is not related to the standard.

we can show the types of criteria in the next table:

It can be pointed out here that the criteria used as quantitative criteria are criterion III, V and VI while criterion I, II and IV are used as qualitative criteria.

The solution steps for the I PROMETHEE and PROMETHEE II methods are

1<sup>st</sup> Step: we put one of the six curves mentioned above for each criterion and attach the instructions associated with.

2<sup>nd</sup> Step: For each pair of alternatives ( $a_i, a_k$ ), total preferences are calculated by formula next:

$$p(a_i, a_k) = \sum_{j=1}^n \pi_j \cdot f_j(a_i, a_k) \quad (5.1)$$

3<sup>rd</sup> step: calculating the flow in and out of each alternative  $a_i$

$$\Phi^+(a_i) = \sum_{a_k \in A : a_k \neq a_i} p(a_i, a_k) \quad (5.2)$$

Positive flow expresses the strength of the alternative  $a_i$

$$\Phi^-(a_i) = \sum_{a_k \in A; a_k \neq a_i} p(a_i, a_k) \quad (5.3)$$

A negative flow expresses a weak alternative  $a_i$

4<sup>th</sup>Step: Determining the two overall arrangements resulting from the alternatives arrangement.

-The first overall arrangement includes the arrangement of alternatives in ascending order  $\Phi^+$ .

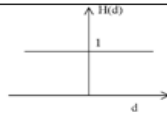
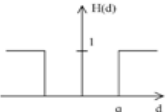
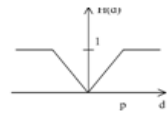
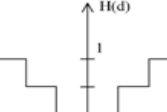
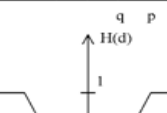
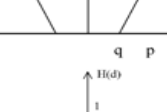
-The second overall arrangement includes the arrangement of alternatives in a decreasing system  $\Phi^-$

-The intersection between the two total arrangements gives us the partial arrangement of method PROMETHEE I

- PROMETHEE II method depends on alternatives arrangement according to the results descending system  $\Phi(a_i)$  which calculated as:

$$\Phi(a_i) = \Phi^+(a_i) - \Phi^-(a_i) \quad (5.4)$$

**Table 5.2:** Various Types of criteria by (Vincke et al,1986)

Type of generalised criteria	Analytical definition	Shape	Parameters to define
Type I. Usual criterion	$H(d) = \begin{cases} 0, & d = 0; \\ 1, &  d  > 0. \end{cases}$		-
Type II. Quasi-criterion	$H(d) = \begin{cases} 0, &  d  \leq q; \\ 1, & \text{otherwise.} \end{cases}$		q
Type III. Criterion with linear preference	$H(d) = \begin{cases} \frac{ d }{p}, &  d  \leq p; \\ 1, &  d  > 0. \end{cases}$		p
Type IV. Level-criterion	$H(d) = \begin{cases} 1, &  d  \leq q; \\ 1/2, & q <  d  \leq p; \\ 1, & \text{otherwise.} \end{cases}$		q, p
Type V. Criterion with linear preference and indifference area	$H(d) = \begin{cases} 1, &  d  \leq q; \\ \frac{ d  - q}{p - q}, & q <  d  \leq p; \\ 1, & \text{otherwise.} \end{cases}$		q, p
Type VI. Gaussian criterion	$H(d) = 1 - \exp\left(-\frac{d^2}{2\sigma^2}\right)$		σ

### 5.3.1. PROMETHEE I & II spatial ranking

The PROMETHEE I partial ranking ( $P^I, I^I, R^I$ ) is gotten from the positive and the negative outranking flows. Both flows do not usually induce the same rankings. PROMETHEE I is their intersection.

$$\left\{ \begin{array}{l} aP^I b \quad \text{iff} \quad \left\{ \begin{array}{l} \phi^+(a) > \phi^+(b) \text{ and } \phi^-(a) < \phi^-(b), \text{ or} \\ \phi^+(a) = \phi^+(b) \text{ and } \phi^-(a) < \phi^-(b), \text{ or} \\ \phi^+(a) > \phi^+(b) \text{ and } \phi^-(a) = \phi^-(b); \end{array} \right. \\ aI^I b \quad \text{iff} \quad \phi^+(a) = \phi^+(b) \text{ and } \phi^-(a) = \phi^-(b); \\ aR^I b \quad \text{iff} \quad \left\{ \begin{array}{l} \phi^+(a) > \phi^+(b) \text{ and } \phi^-(a) > \phi^-(b), \text{ or} \\ \phi^+(a) < \phi^+(b) \text{ and } \phi^-(a) < \phi^-(b); \end{array} \right. \end{array} \right. \quad (5.5)$$

Where  $P^I, I^I, R^I$  respectively stand for preference, indifference and incomparability. When  $aP^I b$  a greater strength of  $a$  is related to a lower weak point of  $b$  with regard to  $b$ . The information of both outranking flows is regular and may also consequently be considered as sure. When  $aI^I b$  each positive and negative flows are equal. When  $aR^I b$  a greater power of one choice is related to a lower weak point of the other. This regularly takes place when  $(a)$  is accurate on a set of standards on which  $(b)$  is weak and reversely  $(b)$  is suitable on some different standards on which  $(a)$  is weak. In such a case the information furnished by using both flows are not consistent. It appears then reasonable to be careful and to consider each choice as incomparable. The PROMETHEE I rating is prudent: it will no longer figure out which motion is first-rate in such cases. It is up to the decision-maker to take his responsibility.

The (5.4) is the balance between the positive and the negative outranking flows. The higher the net flow, the better the alternative, so that:

$$\left\{ \begin{array}{l} aP^{II} b \quad \text{iff} \quad \phi(a) > \phi(b), \\ aI^{II} b \quad \text{iff} \quad \phi(a) = \phi(b). \end{array} \right. \quad (5.6)$$

When PROMETHEE II is considered, all the options are comparable. No incomparabilities remain, but the ensuing statistics can be more disputable due to the fact more records receive lost by means of considering the difference (5.4). The following properties hold:

$$\left\{ \begin{array}{l} -1 \leq \phi(a) \leq 1, \\ \sum_{x \in A} \phi(a) = 0. \end{array} \right. \quad (5.7)$$

When is more outranking all the alternatives on all the criteria, when it is extra outranked. In real-world applications, we advise to each the analysts and the decision-makers to think about each PROMETHEE I and PROMETHEE II. The whole rating is handy to use, but the evaluation of the incomparabilities often helps to finalize an applicable decision. As the net float offers a entire ranking, it might also be compared with a utility function. One benefit of is that it is constructed on clear and simple preference records (weights and preferences functions) and that it does be counted on comparative statements as a substitute than absolute statements(Vincke et al, 1986).

#### 5.4. Application of PROMETHEE to the Project

To determine the importance of each parameters of the hemorrhoid’s treatment techniques, Yager index was used to find the triangular fuzzy numbers.

Table 5.3 shows detailed information about the parameters of hemorrhoid’s treatment techniques.

**Table 5.3:** Parameter Values of hemorrhoid’s treatment techniques

Surgical	Total Cost	Efficiency	Recovery Period	Survival Rate	Practicality	Comfortability	Hospitalization Time	Procedure Time
Stapled Hemorrhoidectomy	1183\$	94%	4-30 days	67%	Medium	Medium	1-3 Days	30 min
Laser Hemorrhoid surgery	9000-12000\$	80%	14-21 days	99%	Low	High	1 day	30-40 min
Open or Closed Hemorrhoidectomy	2911-5384\$	86%	7-14 days	86.6%	High	Medium	6-12hours	less than hour
<b>Non-surgical</b>								
Fiber-Diet with Water	about 3\$/session	Medium	not detected	50%	High	High	no hospitalization	No procedure
The Enema	65\$/tube	Low	not detected	not detected	Medium	Medium	no hospitalization	5 min
Hemorrhoids treatment using Ice	13\$/2packs	High	not detected	not detected	High	High	no hospitalization	15 min
Creams	average of 20\$/tube	Medium	not detected	not detected	High	Medium	no hospitalization	1 min
Infrared coagulation	1600-2000\$	67-96%	7-10 days	67% - 96%	High	High	1 day	5-10 min
Rubber band ligation	500-1500\$	61.4-74.6%	1-2 weeks	60% - 80%	High	High	2-3 days	less than an hour
Sclerotherapy	336-429\$	84%	2 weeks	94%	Medium	High	no hospitalization	15-30 min

Table 5.4 shows the linguistic scale of importance for nonsurgical treatments, using a triangular fuzzy number. Each parameters of hemorrhoid's treatment techniques, classified according to their importance level for nonsurgical treatments.

**Table 5.4:** Linguistic scale of importance for nonsurgical treatments

Linguistic scale for evaluation	Triangular fuzzy scale	Importance ratings of criteria
Very High (VH)	(0.75, 1, 1)	Practicality, Efficiency
Important (H)	(0.50, 0.75, 1)	Survival Rate, Procedure Time
Medium (M)	(0.25, 0.50, 0.75)	Total Cost, Comfortability
Low (L)	(0, 0.25, 0.50)	Recovery Period, Hospitalization Time
Very Low (VL)	(0, 0, 0.25)	-

**Table 5.5:** Visual PROMETHEE Statistics of Hemorrhoids nonsurgical treatment techniques

Parameter	Unit	Minimum	Maximum	Average
Total Cost	\$	3.0	2000	575.71
Efficiency	%	0.25	1.0	0.6
Recovery Period	Days	7	14	5.42
Survival Rate	%	50	96	67.14
Practicality	-	0.5	0.75	0.678
Comfortability	-	0.5	0.75	0.678
Hospitalization Time	Days	0.0	3.0	0.57
Procedure Time	Minutes	0.0	60	17.28

Table 5.6 shows the linguistic scale of importance for surgical treatments, using a triangular fuzzy number. Each parameters of hemorrhoid's treatment techniques, classified according to their importance level for surgical treatments.

**Table 5.6:** Linguistic scale of importance for surgical treatments

<b>Linguistic scale for evaluation</b>	<b>Triangular fuzzy scale</b>	<b>Importance ratings of criteria</b>
Very High (VH)	(0.75, 1, 1)	Practicality, Efficiency
Important (H)	(0.50, 0.75, 1)	Total Cost Survival Rate, Procedure Time
Medium (M)	(0.25, 0.50, 0.75)	Comfortability, Recovery Period, Hospitalization Time
Low (L)	(0, 0.25, 0.50)	
Very Low (VL)	(0, 0, 0.25)	-

**Table 5.7:** Visual PROMETHEE Statistics of Hemorrhoids surgical treatment techniques

<b>Parameter</b>	<b>Unit</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average</b>
Total Cost	\$	1183	12000	6177
Efficiency	%	0.75	0.75	0.75
Recovery Period	Days	4	30	21.66
Survival Rate	%	67	99	84.2
Practicality	-	0.25	0.75	0.5
Comfortability	-	0.5	0.75	0.58
Hospitalization Time	Days	.25	3	1.5
Procedure Time	Minutes	30	60	43.3

Table 5.8 shows the linguistic scale of importance for all hemorrhoids' treatments, using a triangular fuzzy number. Each parameters of hemorrhoid's treatment techniques, classified according to their importance level for surgical treatments.

**Table 5.8:** Linguistic scale of importance for all hemorrhoids' treatments

<b>Linguistic scale for evaluation</b>	<b>Triangular fuzzy scale</b>	<b>Importance ratings of criteria</b>
Very High (VH)	(0.75, 1, 1)	Practicality, Efficiency
Important (H)	(0.50, 0.75, 1)	Total Cost Survival Rate, Procedure Time
Medium (M)	(0.25, 0.50, 0.75)	Comfortability, Recovery Period, Hospitalization Time
Low (L)	(0, 0.25, 0.50)	
Very Low (VL)	(0, 0, 0.25)	-

**Table 5.9:** Visual PROMETHEE Statistics of all hemorrhoids' treatment techniques

<b>Parameter</b>	<b>Unit</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average</b>
Total Cost	\$	3	12000	2259
Efficiency	%	0.25	1	0.65
Recovery Period	Days	4	30	10.3
Survival Rate	%	50	99	72.26
Practicality	-	0.25	0.75	0.625
Comfortability	-	0.5	0.75	0.65
Hospitalization Time	Days	0.0	3.0	0.85
Procedure Time	Minutes	0.0	60	25.1

**CHAPTER 6**  
**RESULTS AND DISCUSSION**

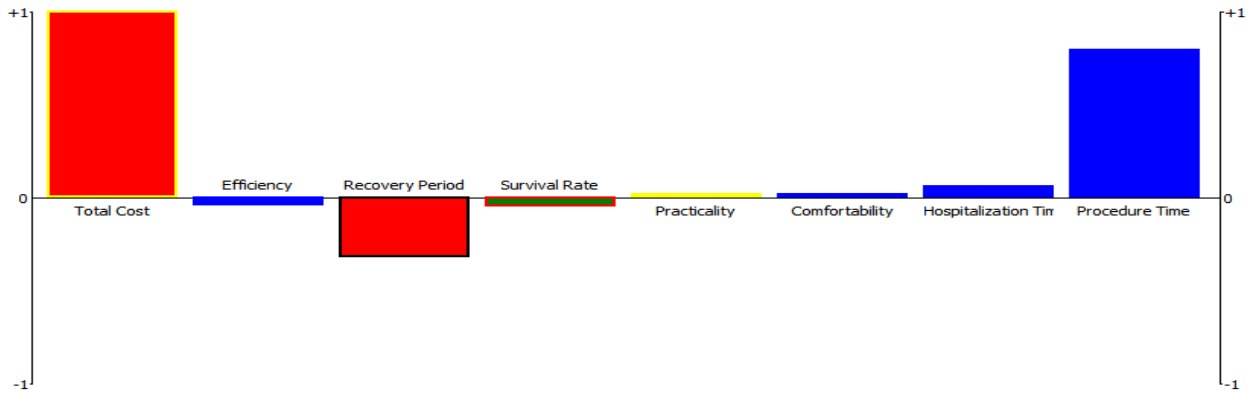
**6.1. Results:** The results of the analysis show that with the set of Total Cost, Efficiency, Recovery Period, Survival Rate, Practicality, Comfortability, Hospitalization Time, and Procedure Time, stapled hemorrhoidectomy is the most preferable treatment technique for surgical treats, fiber-diet with water is the most preferable treatment technique for nonsurgical techniques also for both techniques' types.

**Table 6.1:** Complete ranking for Nonsurgical Hemorrhoids Treatment Techniques (NSHTTs)

<b>Complete Ranking</b>	<b>Techniques</b>	<b>Negative outranking flow</b>	<b>Positive outranking flow</b>	<b>Net flow</b>
<b>1</b>	Fiber-Diet with Water (FDWW)	0,0714	0,2247	0,1533
<b>2</b>	Creams	0,1003	0,1737	0,0734
<b>3</b>	treatment using Ice	0,1290	0,1648	0,0359
<b>4</b>	Sclerotherapy	0,1824	0,1476	-0,0348
<b>5</b>	The Enema	0,1646	0,1285	-0,0361
<b>6</b>	IR coagulation	0,1798	0,1341	-0,0457
<b>7</b>	Rubber band ligation (RBL)	0,2382	0,0923	-0,1460

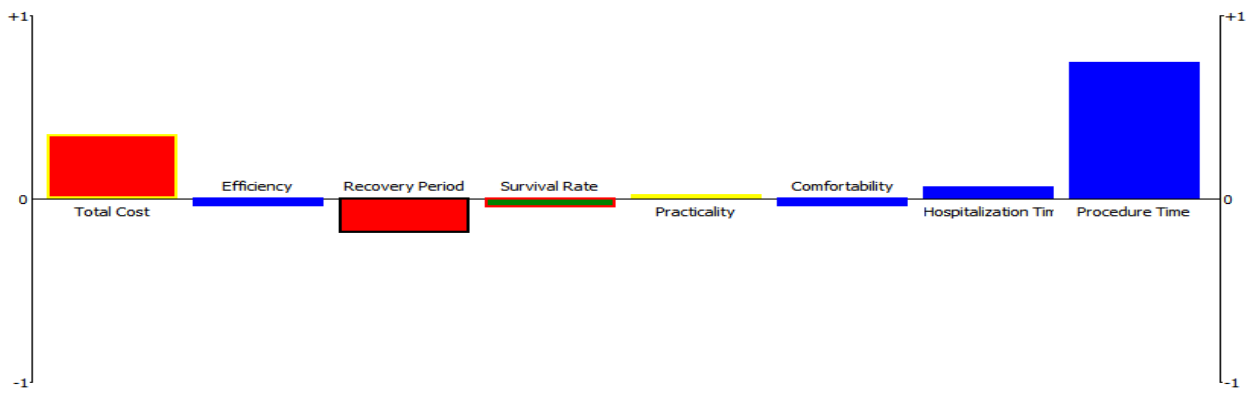
Figure 6.1 shows an action profile of the weak points and strong points about Fiber-Diet with Water for (NSHTTs), having a positive ranking in total cost, practicality, comfortability, hospitalization time, & procedure time but showing a low ranking in efficiency, recovery period, & survival rate.





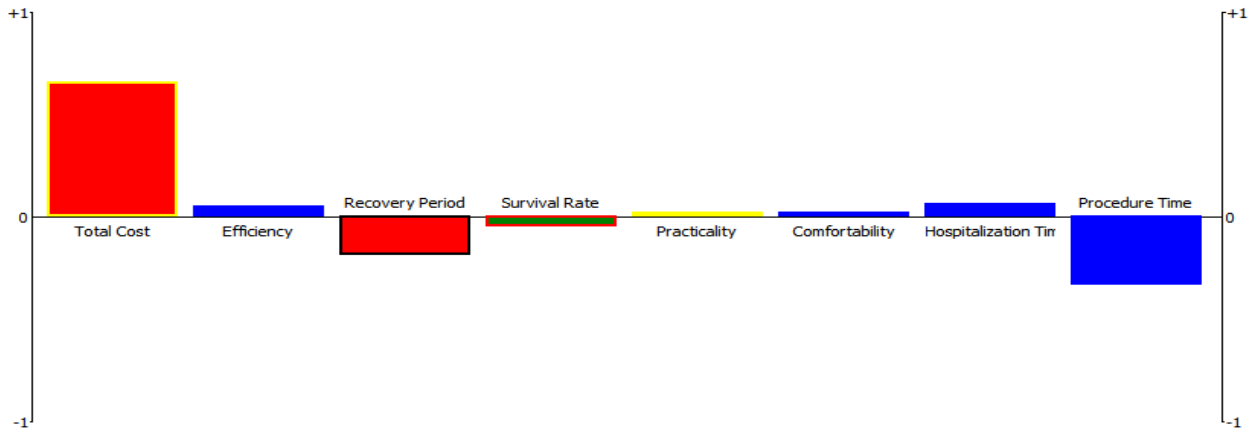
**Figure 6.1:** Action Profile of Fiber-Diet with Water for (NSHTTs)

Figure 6.2 shows an action profile of the weak points and strong points about Creams for (NSHTTs), having a positive ranking in total cost, practicality, hospitalization time, & procedure time but showing a low ranking in efficiency, recovery period, survival rate, & comfortability.



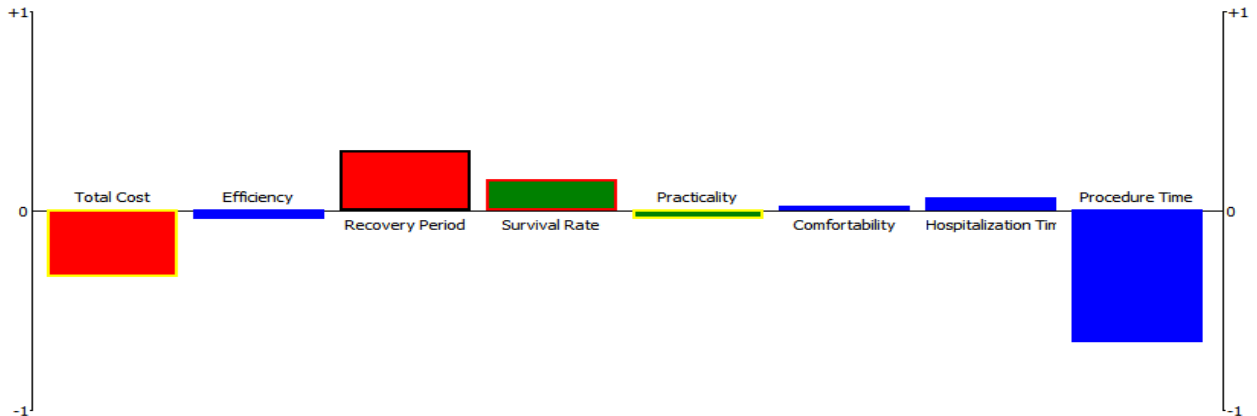
**Figure 6.2:** Action Profile of Creams for (NSHTTs)

Figure 6.3 shows an action profile of the weak points and strong points about hemorrhoids treatment using ice for (NSHTTs), having a positive ranking in total cost, efficiency, practicality, comfortability, & hospitalization time, but showing a low ranking in, recovery period, survival rate, & procedure time.



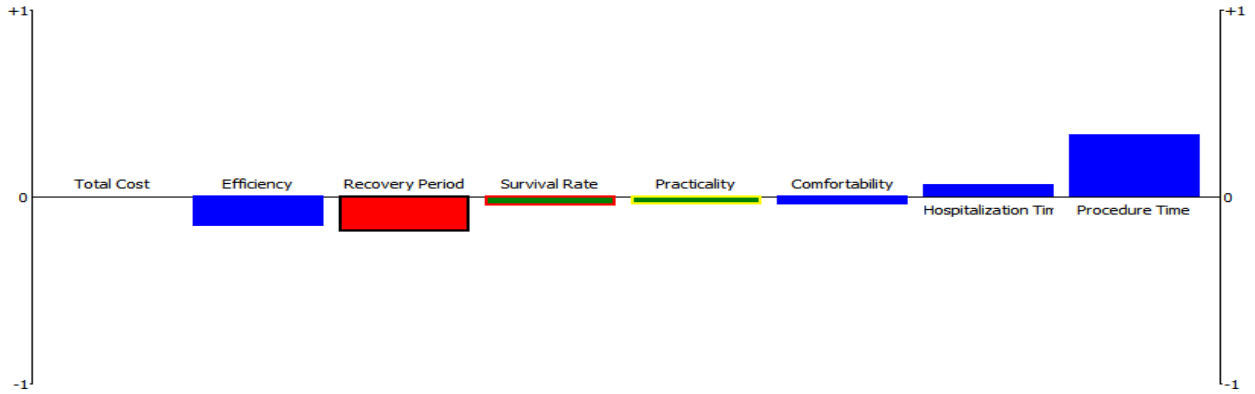
**Figure 6.3:** Action Profile of hemorrhoids treatment using icefor (NSHTTs)

Figure 6.4 shows an action profile of the weak points and strong points about Sclerotherapyfor (NSHTTs), having a positive ranking inrecovery period,survival rate, comfortability, & hospitalization time, but showing a low ranking intotal cost, efficiency, practicality, &procedure time.



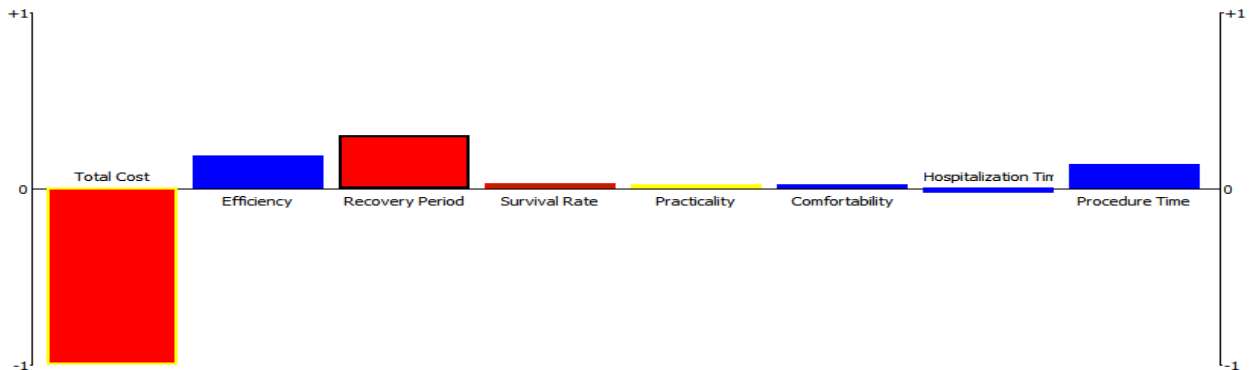
**Figure 6.4:** Action Profile of Sclerotherapyfor (NSHTTs)

Figure 6.5 shows an action profile of the weak points and strong points about Enemafor (NSHTTs), having a positive ranking inhospitalization time,&procedure time but showing a neutral ranking in total cost and low ranking inefficiency, recovery period,survival rate, practicality, & comfortability.



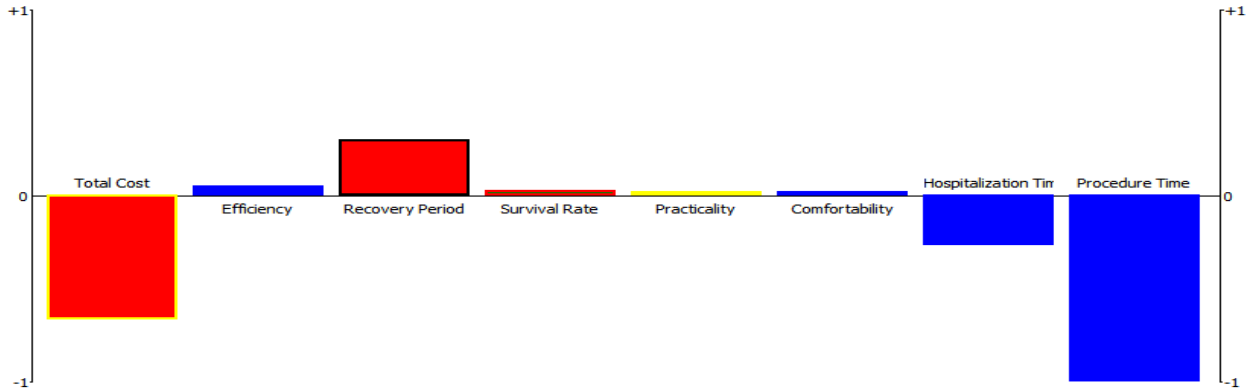
**Figure 6.5:** Action Profile of Enemafor (NSHTTs)

Figure 6.6 shows an action profile of the weak points and strong points about IR Coagulation for (NSHTTs), having a positive ranking in efficiency, recovery period, survival rate, practicality, comfortability, & procedure time, but showing a low ranking in total cost, & hospitalization time.



**Figure 6.6:** Action Profile of IR Coagulation for (NSHTTs)

Figure 6.7 shows an action profile of the weak points and strong points about Rubber band ligation for (NSHTTs), having a positive ranking in efficiency, recovery period, survival rate, practicality, & comfortability, but showing a low ranking in total cost, hospitalization time, & procedure time.

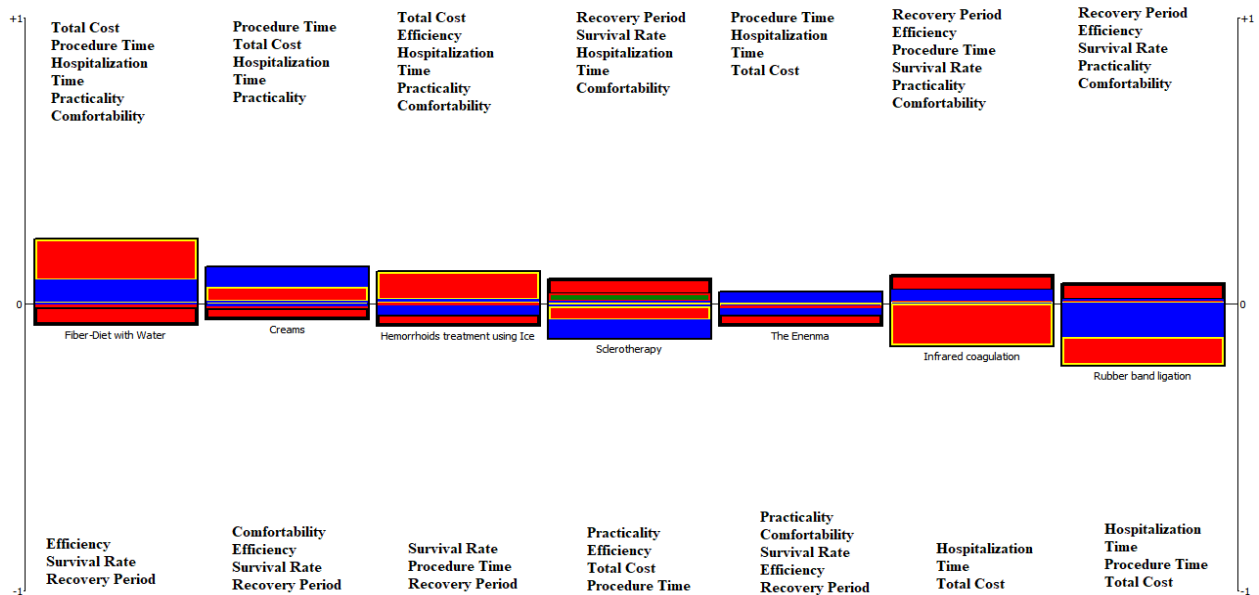


**Figure 6.7:** Action Profile of Rubber band ligation for (NSHTTs)

Figure 6.8 shows a detailed rainbow ranking of the hemorrhoids treatment techniques and their identified parameters that make a technique favourable or unfavourable for NSHTTs.

Techniques from the best to the worst respectively;

FDWW > Creams > Ice > Sclerotherapy > Enema > IR Coagulation > RBL

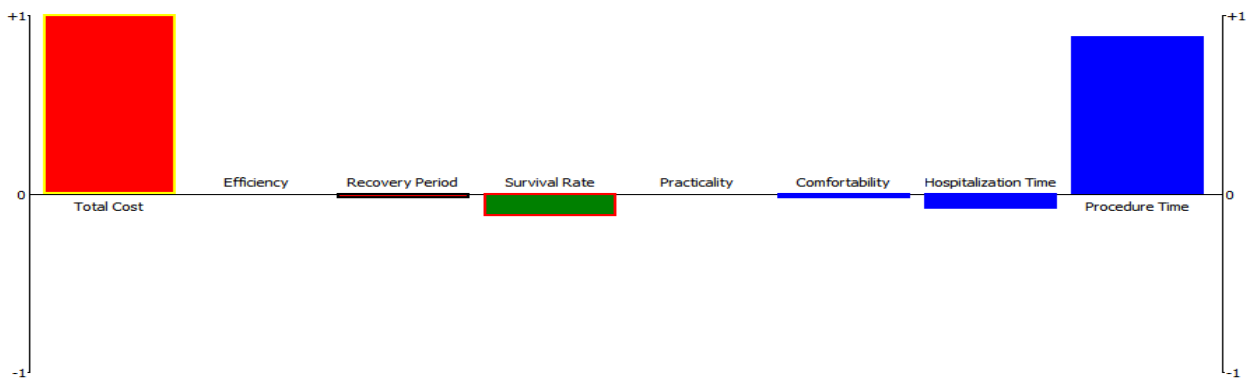


**Figure 6.8:** Positive and Negative Ranking of hemorrhoids treatment techniques for NSHTTs

**Table 6.2:** Complete ranking for Surgical Hemorrhoids Treatment Techniques (SHTTs)

Complete Ranking	Techniques	Negative outranking flow	Positive outranking flow	Net flow
1	Stapled Hemorrhoidectomy	0,0396	0,2248	0,1852
2	Open or Closed Hemorrhoidectomy	0,1592	0,1022	-0,0570
3	Laser Hemorrhoid surgery	0,1928	0,0646	-0,1282

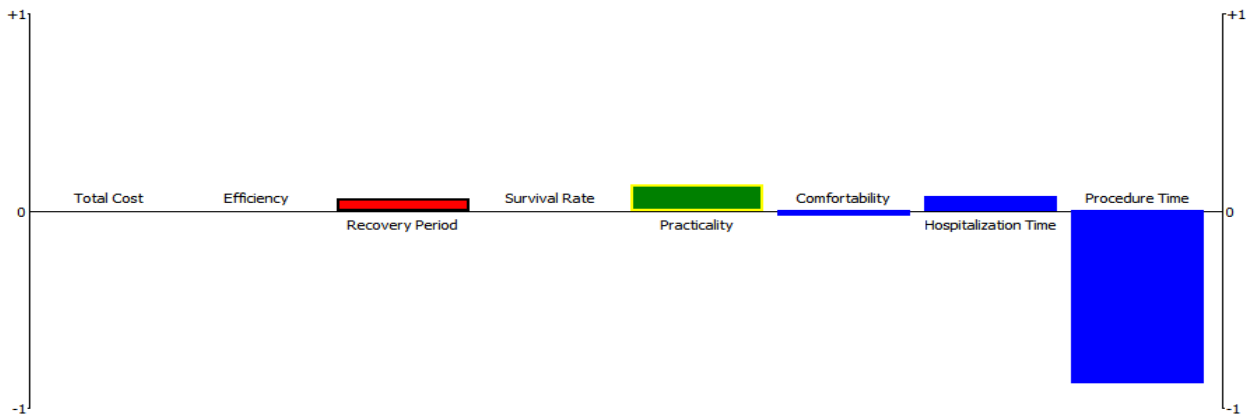
Figure 6.9 shows an action profile of the weak points and strong points about Stapled Hemorrhoidectomy for (SHTTs), having a positive ranking in total cost, & procedure time but showing a neutral ranking in Efficiency, & practicality and low ranking in recovery period, survival rate, comfortability, & hospitalization time.



**Figure 6.9:** Action Profile of Stapled Hemorrhoidectomy for (SHTTs)

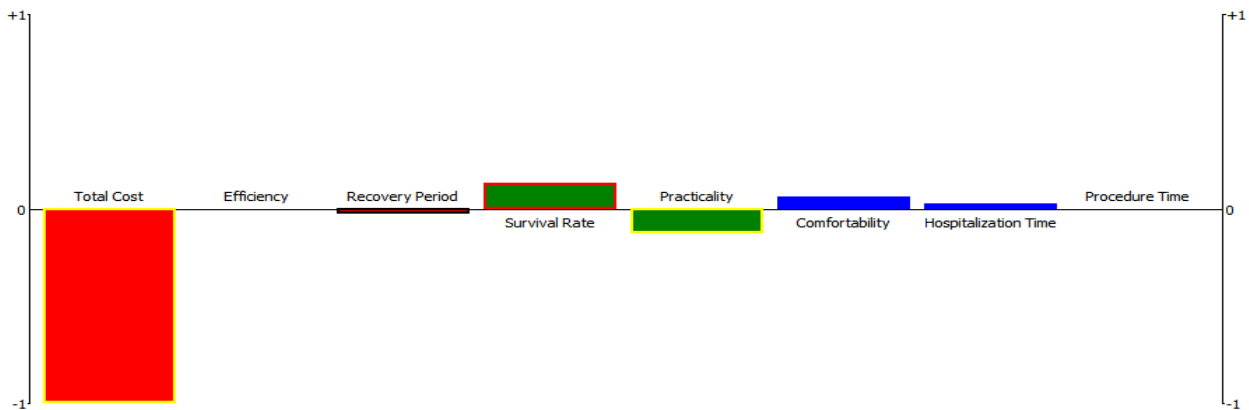
Figure 6.10 shows an action profile of the weak points and strong points about Open or Closed hemorrhoidectomy for (SHTTs), having a positive ranking in recovery period, practicality,

&hospitalization time, but neutral ranking in total cost, efficiency, & survival rate and showing a low ranking in comfortability, & procedure time.



**Figure 6.10:** Action Profile of Open or Closed hemorrhoidectomy for (SHTTs)

Figure 6.11 shows an action profile of the weak points and strong points about Laser Hemorrhoid surgery for (SHTTs), having a positive ranking in survival rate, comfortability, & hospitalization time, but neutral ranking in efficiency, & procedure time and showing a low ranking in total cost, recovery period, & practicality.

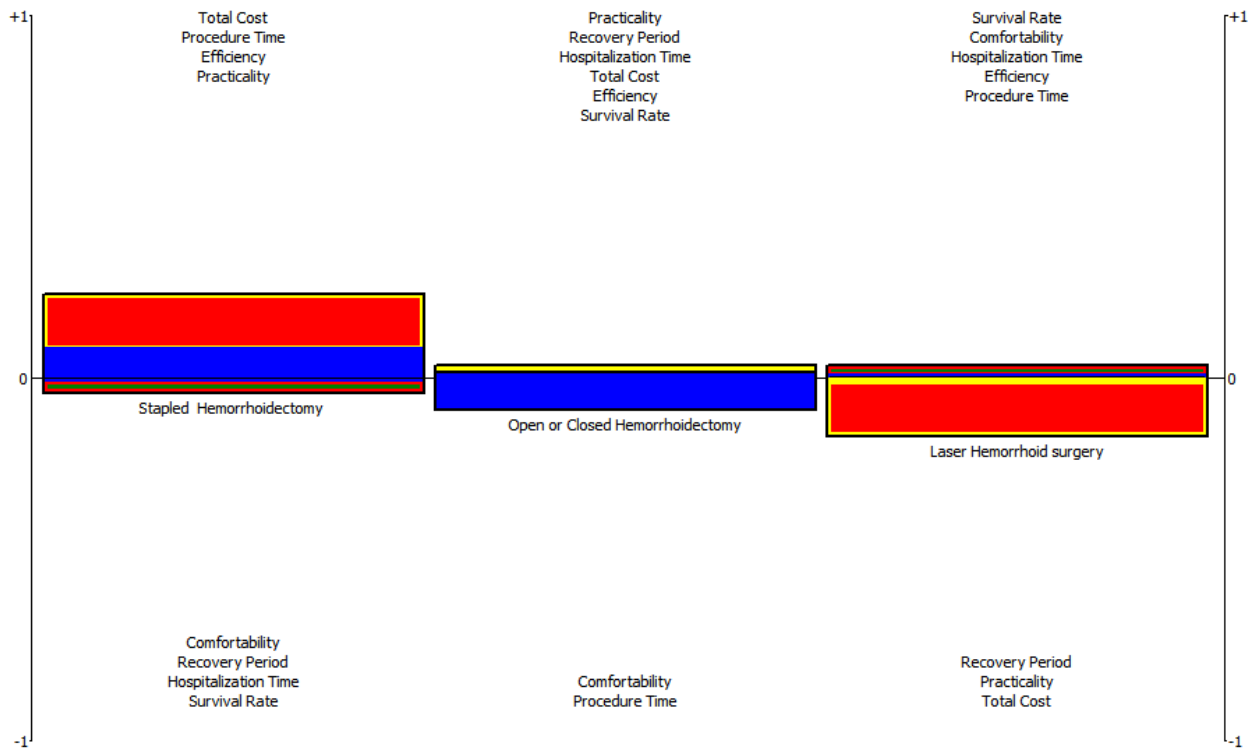


**Figure 6.11:** Action Profile of Laser Hemorrhoid surgery for (SHTTs)

Figure 6.12 shows a detailed rainbow ranking of the hemorrhoids treatment techniques and their identified parameters that make a technique favourable or unfavourable for SHTTs.

Techniques from the best to the worst respectively;

Stapled Hemorrhoidectomy > Open or Closed hemorrhoidectomy > Laser Hemorrhoid surgery

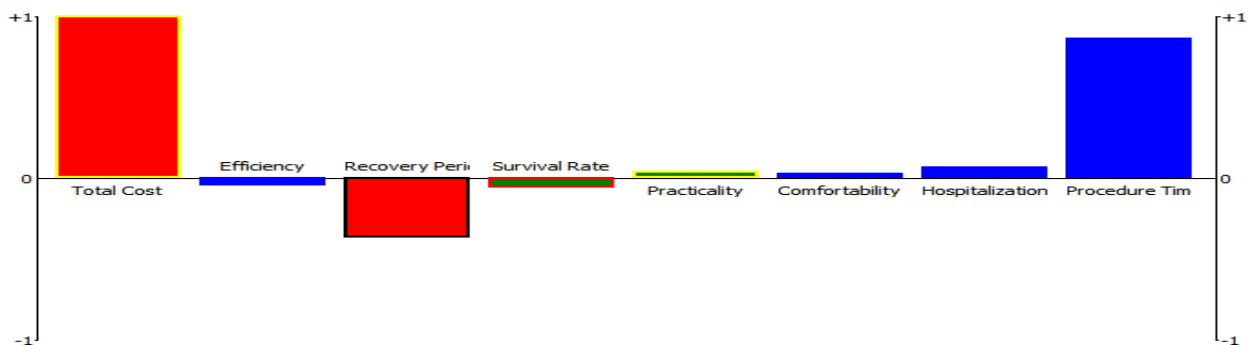


**Figure 6.12:** Positive and Negative Ranking of hemorrhoids treatment techniques for SHTTs

**Table 6.3:** Complete ranking for total Hemorrhoids Treatment Techniques (THTTs)

Complete Ranking	Techniques	Negative outranking flow	Positive outranking flow	Net flow
1	Fiber-Diet with Water (FDWW)	0,0813	0,2344	0,1531
2	Creams	0,0899	0,1992	0,1093
3	treatment using Ice	0,1060	0,1945	0,0885
4	Sclerotherapy	0,1247	0,1873	0,0627
5	The Enema	0,1402	0,1671	0,0268
6	IR coagulation	0,1367	0,1618	0,0251
7	Rubber band ligation (RBL)	0,1815	0,1152	-0,0663
8	Stapled Hemorrhoidectomy	0,1908	0,1007	-0,0901
9	Open or Closed Hemorrhoidectomy	0,2124	0,0697	-0,1427
10	Laser Hemorrhoid surgery	0,2327	0,0664	-0,1663

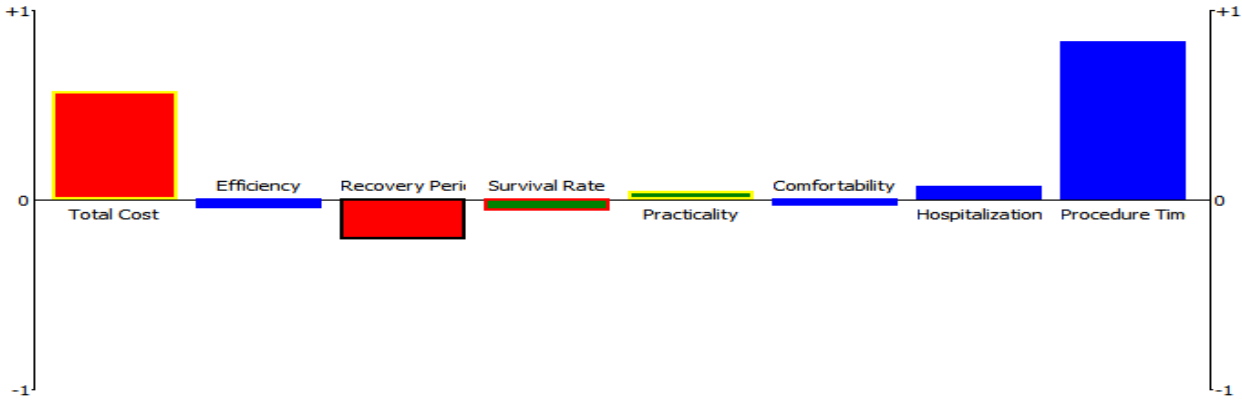
Figure 6.13 shows an action profile of the weak points and strong points about Fiber-Diet with Water for (THTTs), having a positive ranking in total cost, practicality, comfortability, hospitalization time, & procedure time but showing a low ranking in efficiency, recovery period, & survival rate.



**Figure 6.13:** Action Profile of Fiber-Diet with Water for (THTTs)

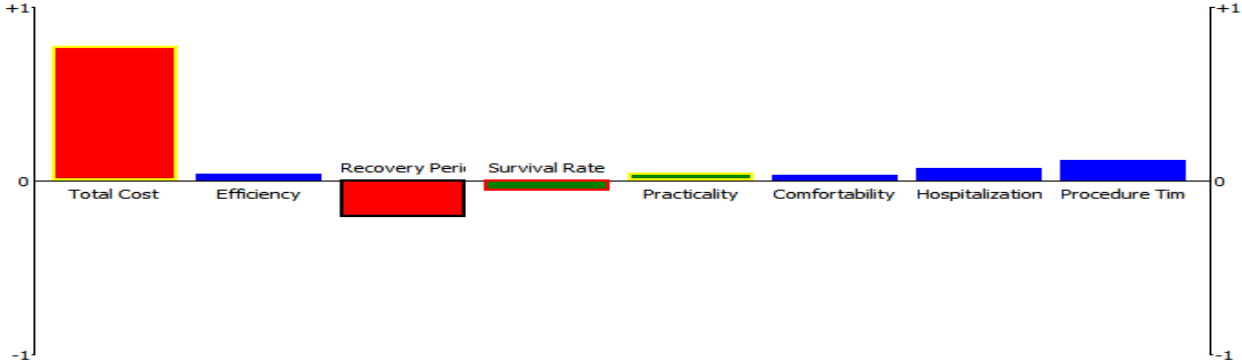


Figure 6.14 shows an action profile of the weak points and strong points about Creams for (THTTs), having a positive ranking in total cost, practicality, hospitalization time, & procedure time but showing a low ranking in efficiency, recovery period, survival rate, & comfortability.



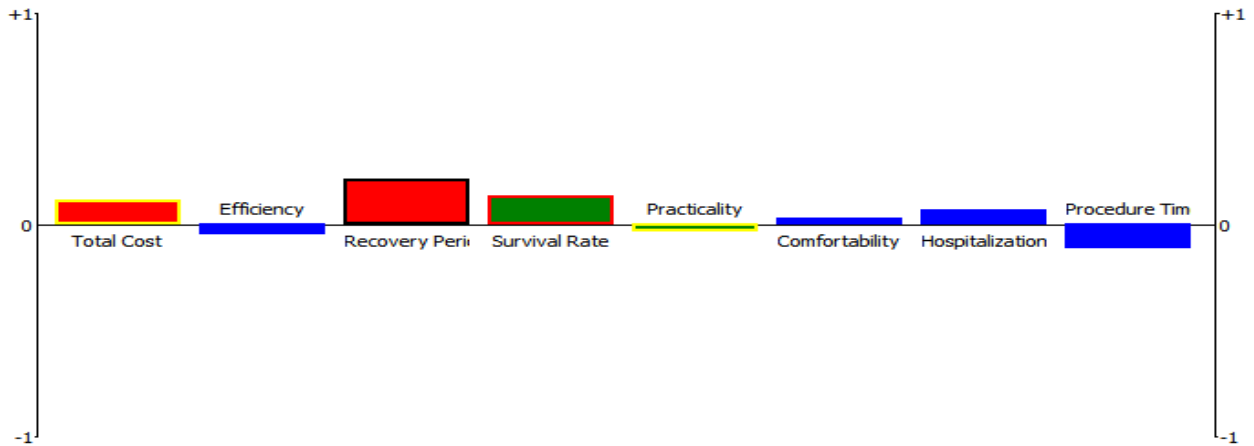
**Figure 6.14:** Action Profile of Creams for (THTTs)

Figure 6.15 shows an action profile of the weak points and strong points about hemorrhoids treatment using ice for (THTTs), having a positive ranking in total cost, efficiency, practicality, comfortability, hospitalization time, & procedure time but showing a low ranking in, recovery period, & survival rate.



**Figure 6.15:** Action Profile of treatment using ice for (THTTs)

Figure 6.16 shows an action profile of the weak points and strong points about Sclerotherapy for (THTTs), having a positive ranking in total cost, recovery period, survival rate, comfortability, & hospitalization time, but showing a low ranking in efficiency, practicality, & procedure time.



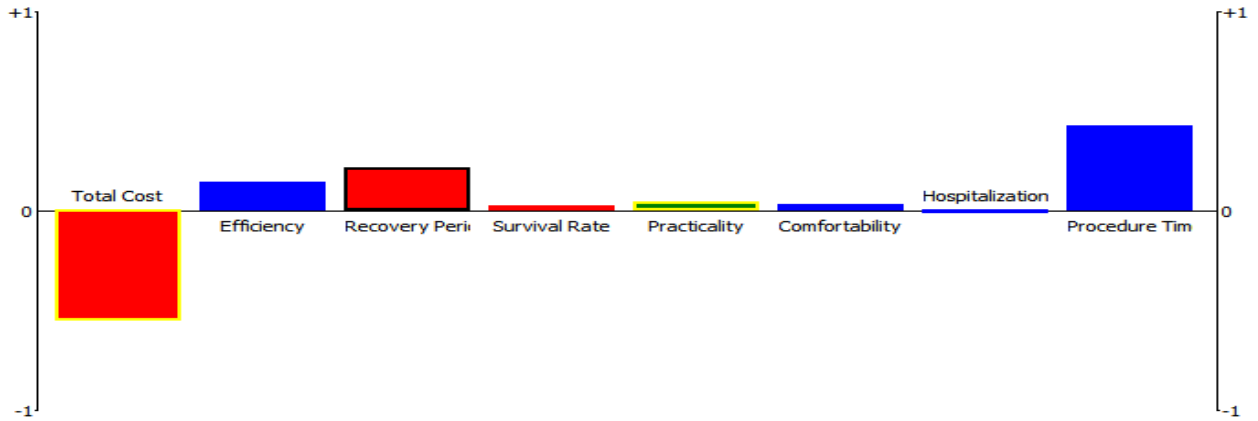
**Figure 6.16:** Action Profile of Sclerotherapy for (THTTs)

Figure 6.17 shows an action profile of the weak points and strong points about Enema for (THTTs), having a positive ranking in total cost, hospitalization time, & procedure time but showing a low ranking in efficiency, recovery period, survival rate, practicality, & comfortability.



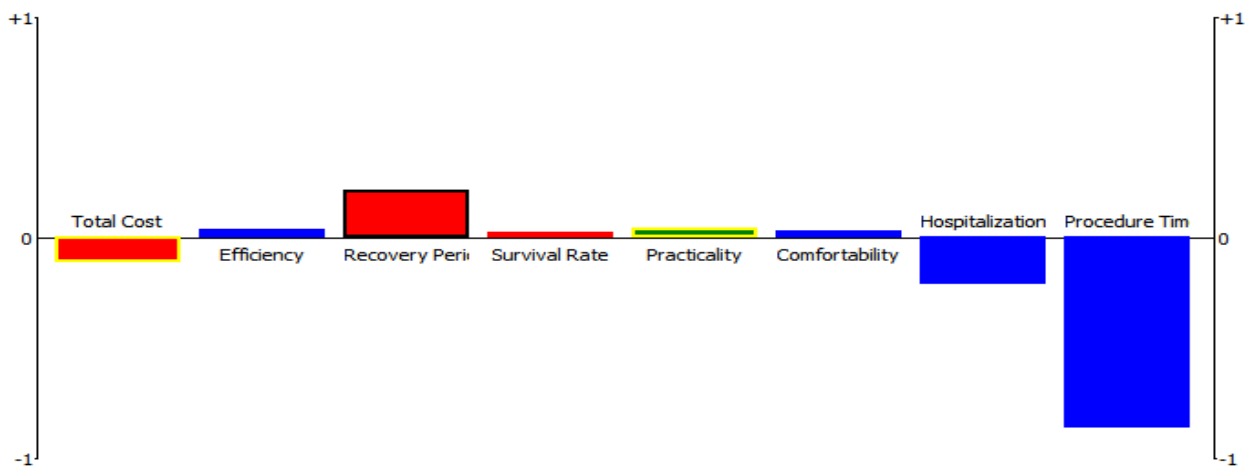
**Figure 6.17:** Action Profile of Enema for (THTTs)

Figure 6.18 shows an action profile of the weak points and strong points about IR Coagulation for (THTTs), having a positive ranking in efficiency, recovery period, survival rate, practicality, comfortability, & procedure time, but showing a neutral ranking in hospitalization time and low ranking in total cost.



**Figure 6.18:** Action Profile of IR Coagulation for (THTTs)

Figure 6.19 shows an action profile of the weak points and strong points about Rubber band ligation for (THTTs), having a positive ranking in efficiency, recovery period, survival rate, practicality, & comfortability, but showing a low ranking in total cost, hospitalization time, & procedure time.



**Figure 6.19:** Action Profile of Rubber band ligation for (THTTs)

Figure 6.20 shows an action profile of the weak points and strong points about Stapled Hemorrhoidectomy for (THTTs), having a positive ranking in Efficiency, & recovery period but showing low ranking in total cost, survival rate, practicality, comfortability, hospitalization time, & procedure time.



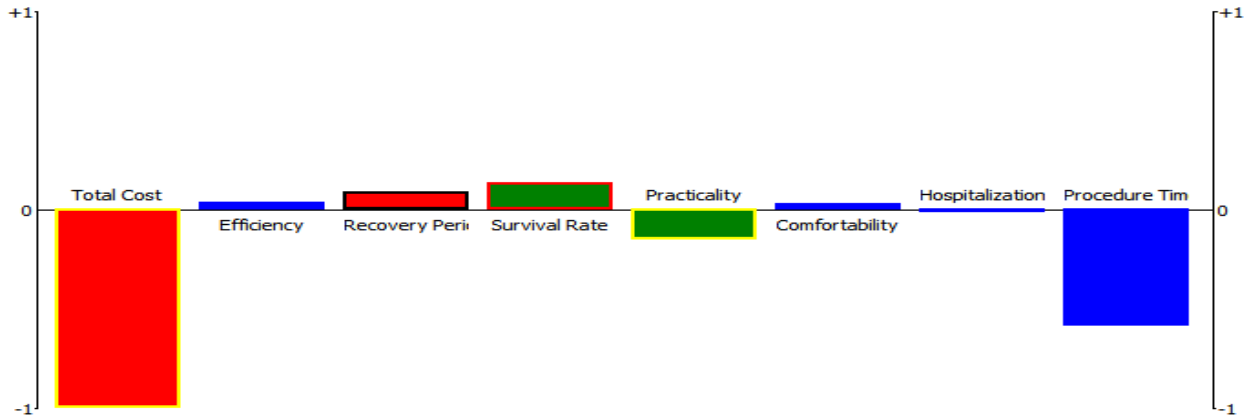
**Figure 6.20:** Action Profile of Stapled Hemorrhoidectomy for (THTTs)

Figure 6.21 shows an action profile of the weak points and strong points about Open or Closed hemorrhoidectomy for (THTTs), having a positive ranking in efficiency, recovery period, survival rate, practicality, & hospitalization time, but showing a low ranking in total cost, comfortability, & procedure time.



**Figure 6.21:** Action Profile of Open or Closed hemorrhoidectomy for (THTTs)

Figure 6.22 shows an action profile of the weak points and strong points about Laser Hemorrhoid surgery for (THTTs), having a positive ranking in efficiency, recovery period, survival rate, & comfortability, but neutral ranking in hospitalization time and showing a low ranking in total cost, practicality, & procedure time.

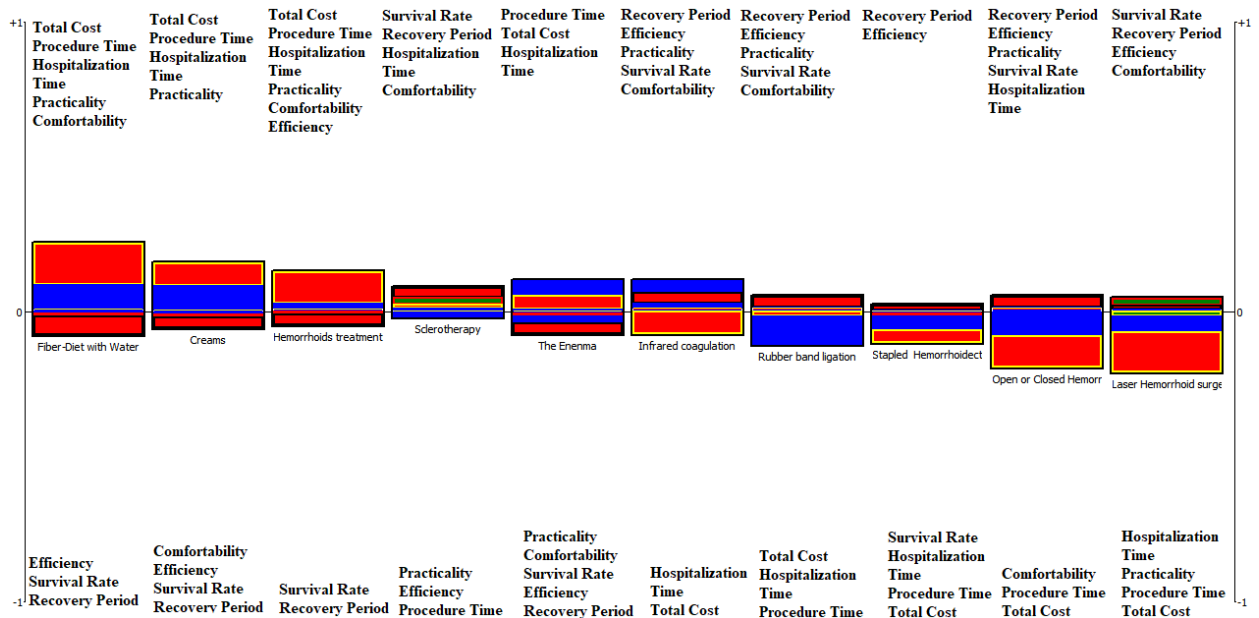


**Figure 6.22:** Action Profile of Laser Hemorrhoid surgery for (THTTs)

Figure 6.23 shows a detailed rainbow ranking of the hemorrhoid's treatment techniques and their identified parameters that make a technique favorable or unfavorable for THTTs.

Techniques from the best to the worst respectively;

FDWW > Creams > Ice > Sclerotherapy > Enema > IR Coagulation > RBL > Stapled Hemorrhoidectomy > Open or Closed hemorrhoidectomy > Laser Hemorrhoid surgery



**Figure 6.23:** Positive and Negative Ranking of hemorrhoids treatment techniques for THTTs

## **6.2. Discussion**

The result of this study provides guidance on the techniques used in the treatment of hemorrhoids for both sorts of treatments surgical and nonsurgical. It increases the treating reliability, which is of great importance for the patient, by presenting the most suitable hemorrhoid treatment techniques according to their detailed parameters.

Patients, who want to have a hemorrhoid treatment, can use this study to determine the most suitable technique for their treating. In this way, the process of treating in early stages, which is of great importance, is speed up. In addition to this, doctors can compare the parameters of the hemorrhoids treatment techniques and they can determine the best options for the patient and the best operation to be made if wanted before applying. As this study is prepared according to the present data, the results can be change with the developing technologies of treatment.

## **CHAPTER 7**

### **CONCLUSION**

The analysis of these study shows that Fiber-diet with water (FDWW) clearly outclassing other Hemorrhoids' treatment techniques for both surgical and nonsurgical techniques. In consequence of its high values in scale of importance like; high in total cost parameter (the rate of money paid per treatment usage), high procedure time (the rate of time to apply the treatment for patient), no hospitalization time (the number days that the patient must stay at the hospital after applying the treatment), high practicality ( the ability of applying the treatment practically without difficulties). FDWW also has low efficiency comparing to the operational techniques, low survival rate and recovery period is too long. FDWW is suitable for patients with the early stages of the disease and also benefits for the little late stages. Patients also can choose to use the second and third best Hemorrhoids' treatment techniques along with FDWW because of their total cost is considering low and they all don't have a hospitalization time which is a money saving and efficiency increasing way of treatment, the techniques are Creams, and hemorrhoids treatment using Ice packs. If we considered just the surgical techniques which are in general considering worse than the nonsurgical techniques, the Stapled Hemorrhoidectomy will be considered as the best one of them due to its high valued parameters comparing to the other surgical treatment techniques. On the other hand, the worst option between the nonsurgical techniques is Rubber Band Ligation and the worst option for the Surgical techniques and for them both as total is Laser Hemorrhoid Surgery due to their less value in scale of importance.

Fuzzy PROMETHEE, provide control mechanism to researcher to check him or her fictitious or real data to observe their potential with comparing, according to importance scale of fuzzy PROMETHEE weighs. As a result, a detailed ranking can be made from the best option to the worst.

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