بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

Sudan University of Science and Technology

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Evaluation of Mannitol as Oral Contrast media in CT Abdomen Examinations

تقييم المنتول وسيطا فمويا للتباين في فحوصات الأشعة المقطعية للبطن

A thesis Submitted for Partial Fulfillment for The Requirement of (M.Sc) Degree in Medical Diagnostic Imaging

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الآية

قال تعالى:

{ وقل ربي زدني علما}

سورة طه114

Dedication

arentsTo my p

To my sisters and brothers

To my friends

To my husband

To my teachers

To who supported me

.To everyone who wishes me success

With love and gratitude

I dedicate this work

Acknowledgements

Firstly we praise Allah. Who blessed me with knowledge

I deeply grateful to my supervisor: Dr : afraa sedig forsupplying me with essential information and for encouragement

I also thanks Asia HospitalstaffA ،lmuoalem hospital staff for greet help

Abstract

This is analytic study was carried out in Almoualem Hospital and and Asia Hospital in computed tomography departments in period from April to June 2018, contains 33 males and 27 females. The problem of study was to evaluate negative of oral contrast media (mannitol) in detecting of bowel pathology that wasn't more carried out on researchs . The main goal of the study is to obtainment good CT abdomen can been diagnosable on bowel pathologys and bowel wall problems . The study was done by CT machine of Toshiba 128 slice for negative oral media of 36 patients after fasting at lest 6hours and GE healthcare 64slice for positive oral media of 24 patients after prepared by castor oil and disflatyl tabs and fasting. The data collected by data sheet which contain ,age ,gender , amount of oral contrast ,patient complications ,lumen appearance and bowel wall appearance and time of oral intake . and analyzed by SSPS. The result revealed that participants who responded positive contrast oral media was poor, while for the majority of who responded nagative contrast oral media were excellent (55%) or good (40%). Lumen appearance does not depend on media bowel wall appearance depends on media. Bowel distension depend on time but not depending on type of oral contrast used and type of oral must be used determined by patient pathology related to. The bowel wall gradually disappears as time of oral intake increases. 71.7% of participants didn't complain, and 28.3%of them had diarrhea as complication .Study found that mannitol is more cheaper and more available than omnipaque. Study recommend that when pathology related to bowel wall or the exam is CTA the perfect choice is negative oral media ,also larger sample should be used in further studies .

الخلاصة

هذه دراسة تحليلية اجريت في مستشفى المعلم التخصصي ومركز اسيا قسم الأشعة المقطعية في الفترة من ابريل–يونيو 2018م.

استهدفت الدراسة 33من الذكور و 27من الإناث.ظهرت مشكلة البحث من قلة الدراسة التي اجريت على المنتول للإستعاضة به عن الامينوبيج شائع الإستخدام في فحوصات الأشعة المقطعية للبطن . الهدف من الدراسة الحصول على إجراء فحص أشعة مقطعية للبطن يمكن من خلاله اكتشاف مشاكل جدار الإمعاء التي غالبا ما لا يتم تشخيص مشاكلها جيدا. تمت الدراسة باستخدام جهاز توشيبا لوسيط التباين الفموي السالب بعد صيام المريض على الاقل ٦ساعات وكذلك جهاز جي إي هليث كير لوسيط التباين الفوي الموجب بعد تحضير المريض ٤٢ ساعة قبل الفحص باستخدام زيت الخروع وحبوب لطرد الغازات والصيام. جمعت البيانات بواسطة إستبيان إحتوى على العمر، النوع، نوع التحضير، كمية الوسيط الفموي، المضاعفات، ظهور جدار الإمعاء، ظهور تجويف الإمعاء، زمن اخذ الوسيط الفموي .تم تحليل البيانات ببرنامج التحليل الإحصائي إس بي إس إس وتوصلت الدارسة الي ان المرضى الذين اخذوا وسيط تباين موجب كان ظهور جدار الامعاء ضعيف بينما المرضى الذين اخذوا وسط التباين السالب كان ظهور جدار الامعاء ٠٤ جيد و ٥٥ ممتاز ، ومما توصلت اليه الدراسة ظهور جدار الامعاء يعتمد على نوع وسيط التباين الفموي المستخدم بينما لا يعتمد ظهور التجويف الإمعائي على نوع الوسيط المستخدم وكذلك إنتفاخ الإمعاء لا يعتمد على نوع وسيط التباين ،ومن النتائج أيضا ظهور الإمعاء وكذلك جدار البطن يتأثر عكسيا بالزمن ، ومما توصلت اليه أن ١٧،٧المرضى لم يعانون اي من الاعراض بينما ٨٢,٣ عانى من الإسهال ،ومما وجد خلال الدراسة أن المنتول أرخص سعرا وأكثر توفرا من الأمينوبيج .توصي الدراسة بإختيار وسيط التباين على حسب موضع المرض وايضا بإجراء دراسات مستقبلية بحجم عينة أكبر.

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List of Abbreviations

CT	computed tomography
CTA	CT Angiography
CM	contrast media
DFOV	display field of view
GIT	gastrointestinal tract
HOCM	high osmolality contrast media
HU	hounsfield unit
IgE	Immunoglobulin E
IOCM	iso osmolality contrast media
IV	intravenous contrast
LOCM	low osmolality contrast media
MDCT	multi detector computed tomography
OH	hydroxy redical
PACs	picture archiving communicated system
PEG	polyethylenegycol
pH	power of hydrogen

Chapter One

Introduction

Chapter one

Introduction

1.1 Introduction

CT abdomen and pelvis is used for the evaluation of the virtually all organs and most vessels. And it requires greater attention to patient preparation than CT evaluation of any other area of the body.Most of CT scan of the abdomen requires administration of an oral contrast agent to demonstrate the intestinal lumen and to distend the gastrointestinal tract. the use of oral contrast material is imperative to differentiate a fluid-filled the bowel a mass or an abnormal collection (Lois E. Romans, 2009).

In the gastrointestinal tract contrast medium (CM) is essential to distinguish loops of bowel from a cyst, abscess, or neoplasm some indications requires rectal contrast administration. In general CM is classified as positive if it appears bright on the image, and negative if it appears dark on the image. the most common definition classifies gastrointestinal tract (GIT) as positive or negative depending on the density of the material relative to wall of the GIT.Barium sulfate solution, or iodinated water –soluble agents can be used as oral CM, And air, carbon dioxide, barium sulfate, or iodinated water – soluble solutions for rectal CM examination. The ideal agent should provide adequate differentiation of bowel from surrounding structures without creating artifact (Lois E. Romans, 2009).

Mannitol is an osmotic diuretic that is metabolically inert humans and occurs naturally, mannitol elevates blood plasma osmolality, resulting in enhanced flow of water from tissues, mannitol may also be used for the promotion of diuresis before irreversible renal failure becomes established ; the promotion of urinary excretion of toxic substances; as an antiglaucoma agent and as a renal function diagnostic aid.

Chemically; mannitol is an alcohol and sugar, has tendency to lose hydrogen ion in aqueous solutions which causes the solution to become

acidic. mannitol is commonly used to increase urine production (diuretic). it is also used to treat or prevent medical condition that are caused by an increase in body fluids/water (e medicine health).

1-2 Problem o the study

Most of CT Abdomenal examination lost of their value when using positive oral contrast media specifically when pathology related to the wall of bowel (large or small).

1-3 Objectives of the study

1-3- General Objective:

The main objective of this study was to evaluate Mannitol as oral contrast media in CT abdomen examinations .

1-3-2 Specific objectives:

- To measure the sensitivity of negative oral contrast media in detecting bowel wall pathology
- To measure the sensitivity of positive oral contrast media in detecting bowel wall pathology
- To assess the value of using mannitol as negative oral contrast media
- To rule out relationship between time intake and each oral contrast appearance.
- To detect patient compilcations on each exam.

1-4 Overview of the study

This study was contain five chapter, chaoter one was an introduction introduce briefly this thesis and contained (general introduction about CT abdomen and oral contrast, problem of the study, general, specific objectives, and overview of the study). Chapter two was literature review about oral contrast media and MDCT used. Chapter three was describe the methodology (materials, methods) used in study. chapter four was included

results . Chapter five discussion of presentation of final findings of the study, conclusion and recommendations for future scope in addition to references and appendices.

Chapter Two

Literature Review

Chapter two

Literature review

2-1 Literature Review

Contrast agents are indispensable in the practice of radiology. Significant improvements in their composition during the past few decades have made them safer and better tolerated, as evidenced by their use in vast numbers of examinations, often in severely ill patients. Nonetheless, risks associated with contrast agents have not been eliminated, and adverse reactions of varying degree continue to occur. The use of contrast agents should be determined on an individual basis according to the clinical circumstances of each patient (Jessica B.Robbins, et.al 2010).

Almost all CTscanning of the abdomen require drinking an oral contrast media which is a liquid solution.scanning is performed 1hour after drinking the oral contrast (water +contrast agent) to allow time for it to pass into the intestine. the oral contrast can improve the quality of the CT study and often results in more accurate diagnosis. in addition many CT scans require intravenous contrast (IV) for these scans, a technologist or nurse must place an IV contrast before the examination. during the scanning, iodine containing contrast is injected through the IV. This IV contrast provides a dramatic improvement in overall quality of the CT images. particularly when evaluating the abdominal organs such as the liver, pancreas and kidneys. Intravenous contrast is also used for CT scanning of neck, chest and pelvis while scanning of these areas can be done without the IV contrast, the lack of contrast limits the quality of these scans.

The intravenous contrast material used at all imaging sites of main line health is universally the safest (non-ionic) agent available. however there are important factors that must be considered for all patients.

Allergies can occur with any contrast agent, whether injected into a vein or ingested orally. some people are allergic to one particular brand of contrast

agent and not to another in the same class. some people are born with allergies to contrast and some develop them over time.

2-1-1 C T Abdomen

CT evaluation of the abdomen and pelvis requires greater attention to patient preparation than CT evaluation of any other area of the body. Most CT scans of the abdomen require the administration of an oral contrast agent to demonstrate the intestinal lumen and to distend the gastrointestinal tract (GIT) (Jessica B.Robbins, et.al 2010).

The use of oral contrast material is imperative to differentiate a fluid-filled loop of bowel from a mass or an abnormal fluid collection. Either a dilute barium suspension or a dilute water-soluble agent may be used with equal effectiveness. In general, the greater the volume of oral contrast material, the better the bowel opacification. Although a volume of at least 600 mL is desired, patient compliance may be a limiting factor. Patients should be given only clear liquids for at least 2 hours before scanning to ensure that food in the stomach is not mistaken for pathologic tissue (Jessica B.Robbins, et.al 2010).

Air and water are excellent as low-attenuation contrast agents. Air or carbon dioxide is frequently used to insufflate the colon for CT colonography, producing a very high negative contrast. Water or a low Hounsfield units (HU) oral barium sulfate suspension (e.g., VoLumen, Bracco Diagnostics) is sometimes used in place of positive contrast agents. These low HU agents will not obscure mucosal surfaces or superimpose abdominal vessels on post processed images. The latter is important in CT angiography (CTA) of the abdomen and pelvis. The use of a low HU oral contrast has an added advantage in that it does not mask radiopaque stones in the common bile duct or urinary tract. Few institutions routinely administer rectal contrast material. When it is used, the most common indication is for colon cancer

staging. The bladder is best appreciated on CT when filled with urine or contrast agent. The vagina is seen in cross section as a flattened ellipse of soft tissue between the bladder and rectum. An inserted tampon will outline the cavity of the vagina with air density and is useful in identification of the vaginal canal (Lois E. Romans, 2009).

Intravenous contrast agents improve the quality of studies of the abdomen and pelvis by opacifying blood vessels, increasing the CT density of vascular abdominal organs, and improving image contrast between lesions and normal structures. The appropriate timing, rate, and dose of the IV contrast agent are essential. For most examinations of the body, image acquisition must be completed before IV contrast medium reaches the equilibrium phase. Modern scanners can accomplish this; as a result pre contrast scans are now seldom obtained for routine abdomen studies, but may be used for specific indications (e.g., diagnosis of fatty infiltration or other alteration of parenchymal attenuation). Multiphasic imaging is frequently used for specialized studies of the pancreas, liver, and kidney as well as in many abdominal CTA protocols. The factors that should be considered in determining appropriate injection protocols for these studies are the same as for other areas of the body, namely contrast medium injection duration, contrast arrival time, and scan duration CT of the abdomen and pelvis is used for the evaluation of virtually all organs and most vessels (Jessica B.Robbins, et.al 2010).

Radiologists systematically examine each organ and structure imaged. In any given slice, much more information is present than can be displayed by any single window width and level setting. A routine soft-tissue window setting (window width approximately 450; window level approximately 50) will adequately display most abdominal anatomy. However, the liver may also be examined using “liver windows” that are narrower (window width approximately 150; window level approximately 70) and intended to

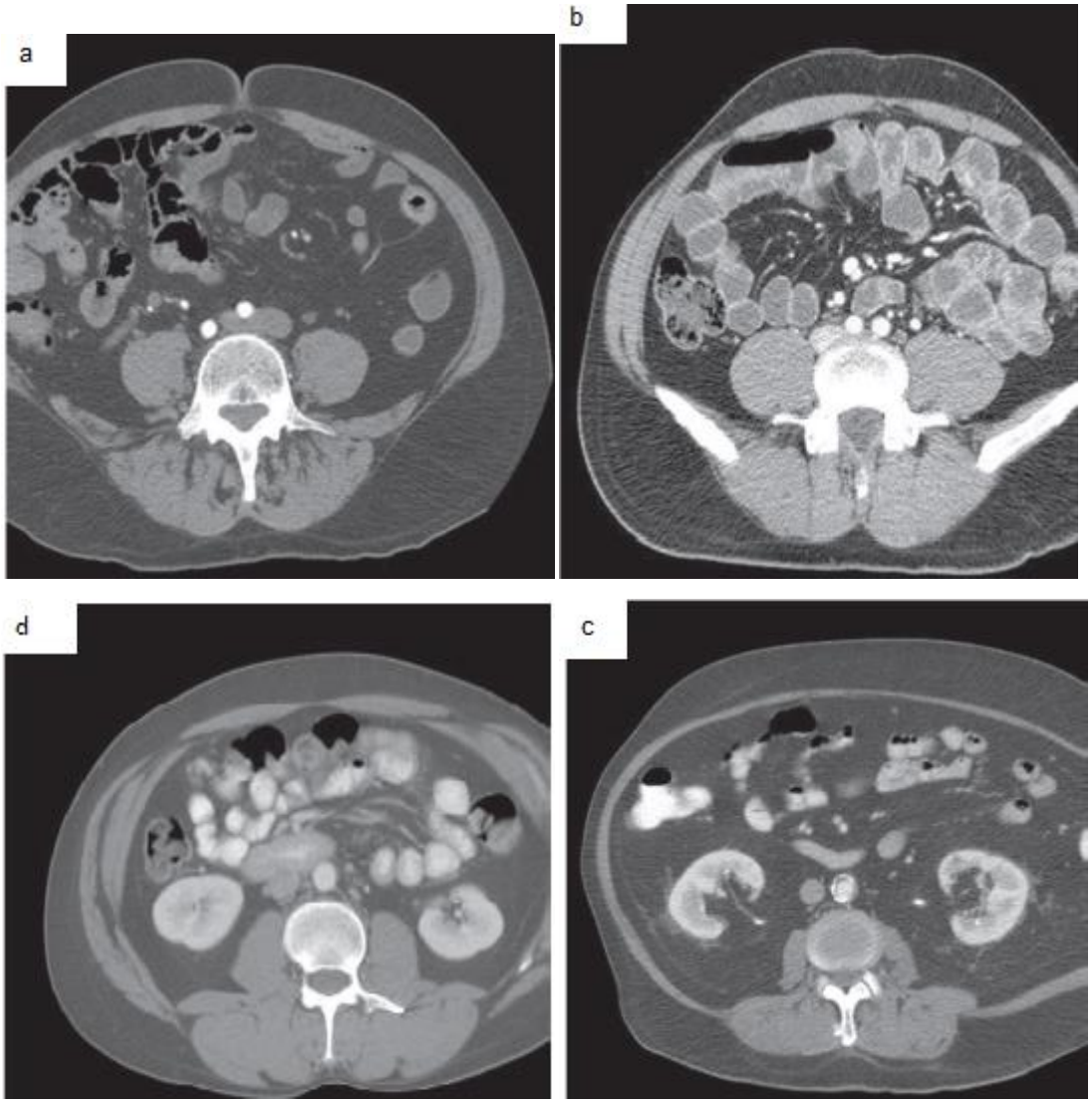
improve the visibility of subtle liver lesions. The lung bases are contained in slices of the upper abdomen and must be viewed using lung windows (window width approximately 1500; window level approximately −600). Bone windows (window width approximately 2000; window level approximately 600) may help to reveal abnormalities of the bones. The display field of view (DFOV) should be just large enough to include the skin surface over the key areas of the body (frequently portions of the arms placed over the head of the patient are cut off to avoid requiring an excessively large DFOV). If previous studies are available, it is generally advisable to use the same DFOV, unless a change in patient condition (e.g., large weight gain) necessitates adjustment. Using the same DFOV as the previous study allows easy visual comparison of any changes in size of lesions or structures when both studies are displayed side by side on PACS monitors or film view boxes (Jessica B.Robbins, et.al 2010).

Although landmarks easily visible on the scout images are often used to guide technologists as to where cross- sectional slices should begin and end, technologists must verify that the anatomy of interest has indeed been scanned. For instance, scans of the abdomen often begin at the base of the lungs and terminate at the iliac crest. However, if cross sectional images that contain the iliac crest still contain sections of the liver, scanning must be extended until the entire liver has been imaged. Similarly, scanning should not start or stop in the middle of obvious abnormality (Jessica B.Robbins, et.al 2010).

2-1-2 Gastrointestinal oral contrast

In the gastrointestinal tract, contrast medium is essential to distinguish loops of bowel from a cyst, abscess, or neoplasm. For this reason, oral contrast material is used in most CT scans of the abdomen and pelvis. For some indications, the rectal administration of contrast material is useful. In

general, contrast media is classified as positive if it appears bright on the image, and negative if it appears dark on the image. The most common definition classifies gastrointestinal agents as positive or negative depending on the density of the material relative to the walls of the gastrointestinal tract. For example, by this definition water is considered a negative agent, because with an HU of 0, it is less dense than the wall of the gastrointestinal tract. Less commonly, contrast media is classified in accordance to its HU; agents with positive HU values are considered positive agents, those with negative HU values are called negative agents. Using this definition, water is considered a neutral agent. Options available in oral preparations include barium sulfate solutions, or iodinated water-soluble agents. Options available for rectal preparations include air, carbon dioxide, barium sulfate, or iodinated water-soluble solutions. The ideal agent should provide adequate differentiation of bowel from surrounding structures without creating artifacts. The images in Figure 2-1 demonstrate the use of water, a low HU barium solution, a standard barium sulfate solution, and an ionic, iodinated agent to highlight the gastrointestinal tract (Jessica B.Robbins, et.al 2010).



Fig(2. 1) These images show the various options in oral contrast agents. Water was used for image (A). VoLumen was used for image (B). Barium sulfate suspension was used for image (C). An ionic, iodinated agent was used for image (D). (In all images the patient was also given an IV contrast agent.)

2-1-2-1 Barium Sulfate Solutions

Conventional radiography barium suspension cannot be used in CT. Such full-strength solutions would cause unacceptable streak artifacts. These conventional agents cannot simply be diluted for use in CT because of their tendency to settle after ingestion. This tendency leads to irregular opacification of the bowel. Fortunately, products are available specifically

for use in CT. The most commonly used are positive agents that contain a 1% to 3% barium sulfate suspension and are specially formulated to resist settling. Commercial barium preparations (e.g., Readi-Cat [E Z EM], Baro-Cat [Mallinckrodt]) may include a number of additives to enhance the mucosal coating properties or to improve the taste for oral use. A higher dose of oral contrast material provides greater bowel opacification. Timing and dose are largely dependent on the area to be opacified. For most examinations a minimum of 500 mL of dilute barium sulfate is given 45 minutes to 2 hours before scanning. An additional 200 mL is given just before scanning to fill the stomach and proximal small bowel. In patients who cannot take fluids by mouth, a nasogastric tube may be inserted. The contrast medium can be introduced through the tube. If vomiting is a problem, slowing the rate of administration may help. The typical low-concentration, low-viscosity barium sulfate solutions may not be adequate for an esophageal study. In such cases, high-viscosity, low concentration, pastes designed for this purpose are recommended. One disadvantage of positive contrast media is that they make mucosal surfaces more difficult to evaluate after IV administration of contrast material. Another problem is that the density of positive contrast material may create streak artifacts or impede three-dimensional modeling. To overcome these disadvantages a low-HU oral barium sulfate suspension was developed (VoLumen, E Z EM). With just 0.1% barium sulfate, the agent resembles water on CT but provides improved distention (as compared with water), faster transit than positive barium sulfate solutions, and more effective visualization of both the bowel wall and the mucosa. On CT images, VoLumen measures from 15 to 30 HU, a density lower than the wall of the GI tract. Hence, it is most often considered a negative agent as defined by attenuation compared with the bowel wall, but by some definitions it is called a neutral agent (Jessica B.Robbins, et.al 2010).

Barium sulfate should not be given if perforation of the gastrointestinal tract is suspected. Barium leaking into the peritoneal cavity is referred to as barium peritonitis. The mortality rate from this complication is significant. It can be prevented by substituting a water-soluble iodinated oral contrast agent whenever perforation is suspected. Barium sulfate is an inert substance that passes through the gastrointestinal tract basically unchanged. Allergic reactions to oral barium sulfate solutions are rare. The product literature reports severe reactions in approximately 1 in 500, 000 cases and fatalities in 1 in 2 million cases. It is likely that these reactions can be attributed to the additives in the suspension (e.g., flavorings). Although procedural complications are rare, they include aspiration pneumonitis, barium impaction, and intravasation. Although definitive answers are not available, fewer complications from aspiration appear to occur with barium sulfate than with high-osmolality iodinated agents (Jessica B.Robbins, et.al 2010).

2-1-2-2 Iodinated Agents

Both HOCM and LOCM are positive agents that can be diluted and administered orally. Because of the unpleasant taste of HOCM, flavoring is normally added to the solution. A 2% to 5% solution of a water-soluble agent is normally used. Even with these dilute solutions, given orally, iodinated contrast agents usually stimulate intestinal peristalsis. Therefore, patients may experience diarrhea after the ingestion of water-soluble agents. Dosages are similar to those used with barium sulfate. However, water-soluble oral contrast material tends to pass through the gastrointestinal tract slightly faster. In most situations, HOCM is used for oral administration because is it less expensive than LOCM and provides equivalent gastrointestinal opacification. However, in selective cases LOCM has advantages over HOCM that justify its increased expense. If aspirated,

LOCM causes less pulmonary edema than HOCM. Researchers of oral contrast medium in newborns have concluded that LOCM offers a significant reduction in complications compared with barium sulfate or HOCM.LOCM should be used in infants and young children under the following conditions: 1) when the possibility of entry of contrast agent into the lung exists; or 2) when the possibility of leaking of contrast agent from the gastrointestinal tract exists. Studies of older children revealed an additional advantage. Because the LOCM has a neutral taste when diluted, patient cooperation is much greater. When rectosigmoid abnormality is suspected, rectal administration of contrast material may be necessary. In these cases, 150 to 200 mL of dilute water-soluble agent (1% to 3%) can be given by enema (Jessica B.Robbins, et.al 2010).

2-1-2-3Comparison of Positive Oral Contrast Agents

Barium sulfate and water-soluble contrast material cause comparable bowel opacification. Because of the low concentrations used, neither coats the mucosa significantly. Instead, most visible contrast is simply from the agents. filling the bowel. Barium sulfate, in small amounts, tends to cling to the intestinal wall, providing a minimum of visible contrast. In comparison, a small quantity of water-soluble oral contrast is usually absorbed by the bowel. Therefore, if a patient is able to drink only a small amount of oral contrast, it is preferable to give them a barium sulfate solution (Jessica B.Robbins, et.al 2010).

2-1-2-4 Water

Water is sometimes used in place of positive contrast agents. As a negative (or neutral) agent, water will not obscure mucosal surfaces, or superimpose abdominal vessels on three-dimensional images. However, water transits quite rapidly and distends the bowel poorly. It will not provide sufficient detail if the bowel is not fully distended (Jessica B.Robbins, et.al 2010).

2-1-2-5 Air and Carbon Dioxide

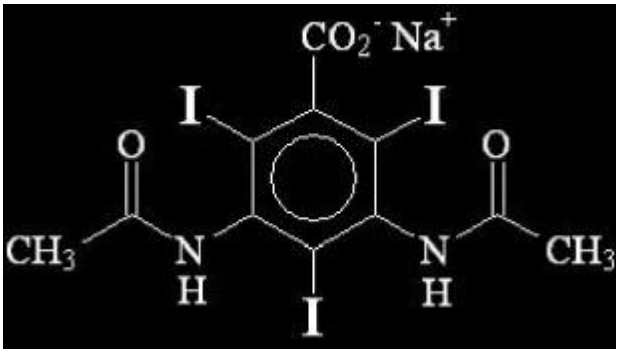
Room air or carbon dioxide can be used to produce a very high negative contrast on images of the gastrointestinal tract. Negative contrast agents are particularly useful in CT colonography when adequate colonic distention is critical for effective polyp detection. Poorly distended segments of bowel may be mistaken for carcinoma. Room air or carbon dioxide is administered via a small flexible rectal catheter. Room air is delivered using a standard handheld air bulb insufflator. This air bulb can be controlled either by the patient or the CT technologist. Carbon dioxide is delivered using an automated insufflation system (PROTOCO 2L, Bracco Diagnostics, Inc.). Both room air and automated carbon dioxide provide reliable colonic distention. However, carbon dioxide has some advantages over room air in that it is readily absorbed by the body and is eliminated by respiration. It induces less spastic response of the bowel wall and is therefore better tolerated by most patients. Room air can result in significant post procedure cramping and discomfort for the patient. In addition, many CT technologists prefer the automated carbon dioxide technique over patient-controlled room air administration. The main reason is that more time is required to coach patients to self-insufflate, whereas automated carbon dioxide requires relatively little patient education to achieve similar results. The antispasmodic medication, glucagon hydrochloride, is sometimes given by intravenous injection to further improve bowel distention (Jessica B.Robbins, et.al 2010).

2-1-3 Pharmacology Of Contrast Agents

All intravascular iodinated contrast agents are based on a tri-iodinated benzene ring. Three primary forms exist:

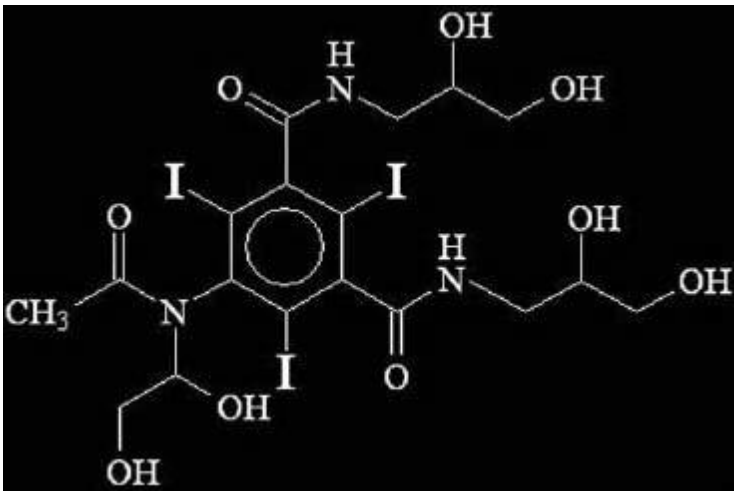
High-osmolar contrast media (HOCM) are the oldest agents. They are relatively inexpensive, but their utility is limited. They are monomers

(single benzene ring) that ionize in solution with a valence of -1. Their cation is either sodium or meglumine (Jessica B.Robbins, et.al 2010).



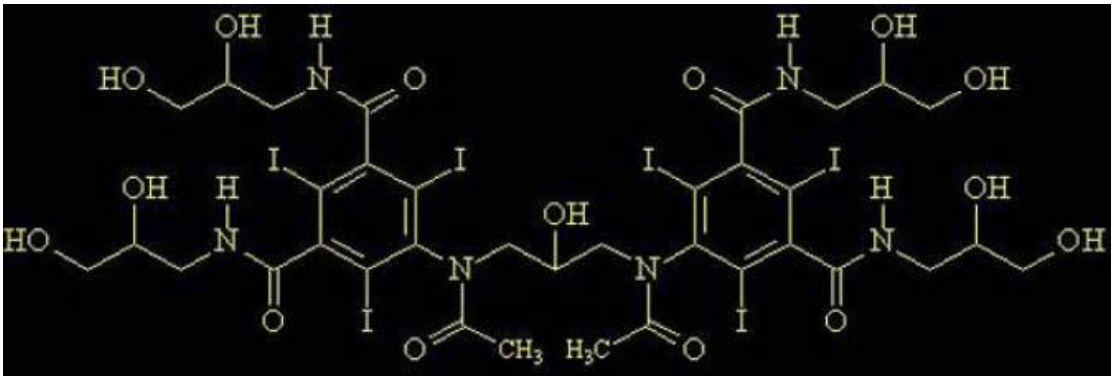
Fig(2. 2) HOCM chemical formulation. (Jessica B.Robbins, et.al 2010)

A major advance was the development of nonionic compounds. They are monomers that dissolve in water but do not dissociate. Hence, with fewer particles in solution, they are designated low-osmolar contrast media (LOCM) (Jessica B.Robbins, et.al 2010).



Fig(2. 3) LOCM chemical formulation. (Jessica B.Robbins, et.al 2010)

The most recent class of agents is dimers that consist of a molecule with two benzene rings (again, each with 3 iodine atoms) that does not dissociate in water (nonionic). These compounds are designated iso-osmolar contrast media (IOCM) (Jessica B.Robbins, et.al 2010).



Fig(2. 4) IOCM chemical formulation. (Jessica B.Robbins, et.al 2010)

The toxicity of contrast agents decreases as osmolality approaches that of serum. This has been accomplished by developing nonionizing compounds and then combining two monomers to form a dimer.

Representative osmolalities are:

Serum: 290 mosm/kg H2O

HOCM: Ionic monomer: diatrizoate: 1570 mosm/kg H2O

LOCM: Nonionic monomer: iohexol 240 (Omnipaque): 518 mosm/kg H2O

* LOCM: Nonionic monomer: iohexol 300 (Omnipaque): 672 mosm/kg H2O

* IOCM: Nonionic dimer: iodixanol 320 (Visipaque): 290 mosm/kg H2O

* Agents presently used at the University of Wisconsin Hospital and Clinics(Jessica B.Robbins, et.al 2010).

Since the purpose of these agents is to deliver iodine in sufficient concentration for imaging, the ratio of iodine atoms to particles in solution becomes important. Ratios are:

HOCM–.5

LOCM–3.0

IOCM –6.0

Additional modifications that have reduced toxicity include the following: adding calcium ions (reduces cardiac toxicity), establishing a neutral pH (low pH predisposes to vasodilatation), and altering number and distribution of –OH ions (decreases neural toxicity).

Currently used iodinated agents are cleared almost completely by glomerular filtration. With reduced renal function, there is vicarious excretion primarily in bile and through the bowel. Circulatory half life is 1–2 hours, assuming normal renal function(Jessica B.Robbins, et.al 20.10).

2-1-3-1Methods Of Categorizing Contrast Reactions

There are two useful ways to approach contrast reactions. One is to categorize them according to their severity. This method has immediate clinical relevance when reactions occur and provides a framework for determining an appropriate course of treatment. The other approach is to analyze them according to the type of adverse reaction. This is important to understand the mechanisms of reactions(Jessica B.Robbins, et.al 2010).

2-1-3-1-1 Severity:

The American College of Radiology has divided adverse reactions to contrast agents into the following categories:

2-1-3-1-1-1 Mild

Signs and symptoms appear self-limited without evidence of progression: Nausea, vomiting, Altered taste Sweats, Cough, Itching Rash, hives, Warmth (heat), Pallor, Nasal stuffiness, Headache, Flushing Swelling: eyes-face, Dizziness, Chills, Anxiety, Shaking

Treatment: Observation and reassurance. Usually no intervention or medication is required; however, these reactions may progress into a more severe category.

2-1-3-1-1-2 Moderate

Reactions which require treatment but are not immediately life-threatening: Tachycardia/bradycardia, Hypotension, Bronchospasm, wheezing, Hypertension, Dyspnea, Laryngeal edema, Pronounced cutaneous, Pulmonary edema reaction.

Treatment: Prompt treatment with close observation

2-1-3-1-1-3 Severe

Life-threatening with more severe signs or symptoms including:

Laryngeal edema, Profound hypotension, Unresponsiveness (severe or progressive), Convulsions, Cardiopulmonary arrest Clinically manifest, arrhythmias.

Treatment: Immediate treatment. Usually requires hospitalization.

Fortunately, most reactions are classified as mild. Within this category, itching, flushing, hives, nasal congestion, and swelling about the eyes and face are common. Nausea and vomiting have become less common with the use of low osmolar and iso-osmolar agents. Among the moderate reactions, bronchospasm and laryngeal edema are encountered most frequently; patients must also be monitored carefully for changes in cardiac rate and blood pressure. Severe reactions, while infrequent, can rapidly escalate to a life-threatening situation (Jessica B.Robbins, et.al 2010).

2-1-3-2Delayed Contrast Reactions

Delayed contrast reactions can occur anywhere from 3 hours to 7 days following the administration of contrast. Since patients are generally discharged from the radiology department within 30 minutes of contrast administration, these reactions are rarely observed by the radiologist supervising the contrast administration. These events are often not brought to the attention of the radiologist since the delayed event may not be ascribed to the contrast media and these evens are often self limited. Regardless, it is important for anyone administering intravenous contrast media to be aware of delayed reactions.

With the exception of contrast-induced nephropathy, the more common reactions include a cutaneous xanthem, pruritis without urticaria, nausea, vomiting, drowsiness, and headache. While cardiopulmonary arrest has been reported, it is probably not related to newer contrast agents. Cutaneous

reactions are the most frequent form of delayed contrast reaction with a reported incidence of 0.5-9%.

Cutaneous reactions vary in size and presentation but are usually pruritic. For the most part, these reactions are self-limited and symptoms can be treated with corticosteroid creams. Rare cases may progress to become severe, some resembling Stevens-Johnson syndrome or a cutaneous vasculitis. Consultation with a dermatologist is appropriate for delayed cutaneous reactions.

Delayed cutaneous reactions are more common in patients who have had a previous contrast reaction and in those who have been treated within the past 2 years, or are currently being treated with interleukin-2 (IL-2). Due to this association, the University of Wisconsin Hospitals and Clinics screens patients for a history of IL-2 therapy. While the exact mechanism of the delayed reaction is unknown, they can recur if the same contrast medium is administered again. Therefore, it is possible that these delayed reactions are T-cell mediated. As such, prophylaxis with oral corticosteroids may not be useful (Jessica B.Robbins, et.al 2010). .

2-1-3-1-2 Mechanism

- ✓ Anaphylactoid
- ✓ Nonanaphylactoid
  - i. Chemotoxic – organ-specific
    - Nephrotoxicity
    - Cardiovascular toxicity
    - Neurotoxicity
  - ii. Vasovagal

2-4-1-2-1 Anaphylactoid Reactions

Pathophysiology

Anaphylactic reactions are events initiated when an allergen and IgE combine to induce mast cells to release chemical mediators. Mast cells originate from bone marrow precursors and develop in the organs in which they come to reside. Principal locations are the skin, respiratory tract, GI tract, and blood vessels.

Allergen-specific IgE is bound on the surface of mast cells. The allergen-IgE complex activates the mast cell and induces it to release histamine as well as other mediators.

Histamine binds to specific receptor sites. H1 receptors are found in endothelial and smooth muscle cells and in the central nervous system. H2 receptors are in gastric parietal cells and in inflammatory cells.

The nature of an anaphylactic reaction depends upon the location where it occurs. In the skin, vasodilatation produces urticaria and erythema. In mucosa, vasodilatation produces nasal congestion and laryngeal edema. In the respiratory tract, smooth muscle contraction produces bronchospasm. In peripheral vessels, vasodilatation produces hypotension and shock. Gastrointestinal reactions include nausea, vomiting, diarrhea, and cramps (Jessica B.Robbins, et.al 2010).

Anaphylactoid reactions are identical to anaphylactic reactions in their manifestations, but they are not initiated by an allergen-IgE complex. Indeed, the pathway by which the mast cells become stimulated has not yet been clarified. Acute contrast reactions are included in this group.

The distinction between anaphylactic and anaphylactoid reactions is subtle, but it has certain important implications for the use of iodinated contrast:

1. A reaction can occur even the first time contrast is administered.

The severity of a reaction is not dose-related; therefore a test dose is of no value.

2. The occurrence of a contrast reaction does not necessarily mean that it will occur again (although the risk is greater that it may).

Even though the circulating contrast is systemic, the nature of the response is variable. More than one type of reaction may occur simultaneously (Jessica B.Robbins, et.al 2010).

As with anaphylactic reactions, certain risk factors make patients more susceptible to iodinated contrast (anaphylactoid) reactions:

- Allergic asthma
- Drug allergies
- Food allergies
- Prior reactions to contrast

(Jessica B.Robbins, et.al 2010).

2-1-3-1-2-2Nonanphylactoid Reactions

There are three categories of nonanaphylactoid reactions:

I. Chemotoxic – organ-specific

- Nephrotoxicity.
- Cardiovascular toxicity.
- Neurotoxicity.

II. Vasovagal

III. Idiopathic

I. Chemotoxic

A. Nephrotoxicity

Physiology

The kidneys receive 20–25 percent of resting cardiac output, approximately 1.2–1.3 liters every minute. Glomerular filtration rate is about 125 mL/min, or 180 liters per day. Urine volume is approximately 1 liter daily, indicating that the kidneys reabsorb more than 99 percent of the glomerular filtrate.

Iodinated contrast agents have a molecular weight in the range of 600–1650 g/mol. From the vascular compartment, they pass through capillaries into the extracellular space. Until eliminated, they remain in the vascular and interstitial compartments, normally entering only cells of the proximal convoluted tubule. Clearance is almost entirely by glomerular filtration. Contrast agents can easily pass through the glomeruli, which can filter molecules up to 40, 000 mw.

Pathogenesis

It is well established that iodinated contrast can exert a nephrotoxic effect. Three general types of mechanisms have been described.

1-Vascular changes. Primarily a hyperosmotic effect where hypertonic solution in the tubules inhibits water reabsorption, causing the tubules to swell and intrarenal pressure to rise. As a result, both renal blood flow and glomerular filtration decrease.

2-Tubular injury. Evidence for a toxic effect is based on observations of reduced clearance of paraaminohippurate under certain conditions and also a rise in the urinary excretion of enzymes found in proximal tubular cells (Jessica B.Robbins, et.al 2010).

Renal Toxicity Due to Contrast Agents:

Acute renal failure is a clinical entity characterized by an abrupt decline in renal function. Among hospitalized patients, contrast agents have been listed as the third most common cause of acute renal failure for inpatients, behind hypotension and surgery.

Although institutional criteria vary, in general acute renal failure is defined when the serum creatinine raises 25–50 percent or 0.5–1 mg/dL. Serum creatinine peaks in 3–5 days but may be elevated as early as the first day. Clinical manifestations are highly variable and may be absent or proceed to oliguria (urine output < 400 mL/24h). Most effects are temporary and completely reversible. In mild cases, serum creatinine returns to normal in 2

weeks. When severe, dialysis may be necessary (Jessica B.Robbins, et.al 2010).

B. Cardiovascular toxicity :

Patients with underlying cardiac disease have an increased incidence and/or severity of cardiovascular side effects. Pulmonary angiography and intracardiac and coronary artery injections carry the highest degree of risk. Possible reactions include hypotension, tachycardia, and arrhythmias. More severe, but uncommon reactions include congestive heart failure, pulmonary edema, and cardiac arrest (Jessica B.Robbins, et.al 2010).

C. Neurotoxicity

Iodinated contrast agents cause a change in the blood-brain barrier due to their hypertonicity. These risks are reduced when low or iso-osmolar agents are used.

Potential reactions include headache, confusion, seizures, altered consciousness, visual disturbances, and dizziness (Jessica B.Robbins, et.al 2010).

II. Vasovagl Reactions

Vasovagal reactions are characterized by bradycardia and hypotension.

Initial resuscitation should include elevating the legs and/or placing the patient in a Trendelenburg position and administering oxygen at the rate of 6–10 liters/minute.

Atropine may be used in the initial treatment of bradycardia. Epinephrine may be necessary. See section on treatment of anaphylactoid reactions for appropriate doses.

IV fluids are used to treat hypotension and should be administered rapidly. Large volumes may be required. Normal saline and Lactated Ringer’s are appropriate choices.

It is important to monitor vital signs frequently to titrate the amount of medications and fluids that are used (Jessica B.Robbins, et.al 2010).

2-1-4 Mannitol

is a type of sugar alcohol which is also used as a medication. As a sugar, it is often used as a sweetener in diabetic food, as it is poorly absorbed from the intestines. As a medication, it is used to decrease pressure in the eyes, as in glaucoma, and to lower increased intracranial pressure. Medically, it is given by injection. Effects typically begin within 15 minutes and last up to 8 hours.

Common side effects from medical use include electrolyte problems and dehydration. Other serious side effects may include worsening heart failure and kidney problems. It is unclear if use is safe in pregnancy. Mannitol is in the osmotic diuretic family of medications and works by pulling fluid from the brain and eyes.

The discovery of mannitol is attributed to Joseph Louis Proust in 1806. It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.It was originally made from the flowering ash and called manna due to its supposed resemblance to the Biblical food.

2-1-4-1 Medical uses

Mannitol is used to reduce acutely raised intracranial pressure until more definitive treatment can be applied, e.g., after head trauma. It may also be used for certain cases of kidney failure with low urine output, decreasing pressure in the eye, to increase the elimination of certain toxins, and to treat fluid build up. Mannitol acts as an osmotic laxative in oral doses larger than 20 g, and is sometimes sold as a laxative for children.

The use of mannitol, when inhaled, as a bronchial irritant as an alternative method of diagnosis of exercise-induced asthma has been proposed..

Mannitol is commonly used in the circuit prime of a heart lung machine during cardiopulmonary bypass. The presence of mannitol

preserves renal function during the times of low blood flow and pressure, while the patient is on bypass. The solution prevents the swelling of endothelial cells in the kidney, which may have otherwise reduced blood flow to this area and resulted in cell damage.

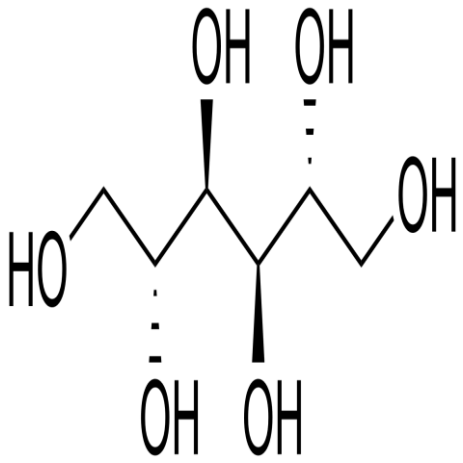
Mannitol can also be used to temporarily encapsulate a sharp object (such as a helix on a lead for an artificial pacemaker) while it is passed through the venous system. Because the mannitol dissolves readily in blood, the sharp point will become exposed at its destination.

Mannitol is also the first choice for the treatment of acute glaucoma in veterinary medicine. It is administered as a 20% solution intravenously. It dehydrates the vitreous humor and, therefore, lowers the intraocular pressure. However, it requires an intact blood-ocular barrier to work.

2-1-4-2 Chemistry

Mannitol is an isomer of sorbitol, another sugar alcohol; the two differ only in the orientation of the hydroxyl group on carbon 2. While similar, the two sugar alcohols have very different sources in nature, melting points, and uses

2-1-4-3 Formula $C_6H_{14}O_6$



Fig(2. 5) mannitol chemical formula

2-1-4-4 Contraindications

Mannitol is contraindicated in people with anuria, congestive heart failure, and active cerebral haemorrhage.

2-2 Previous studies

In 1994 peter ouagliano had performed extensive research evaluation of using barium sulfate and oral iodinated contrast media in CT abdomen pelvis studies

He recognized the value of both barium and iodine contrast media types of specific patient populations, he supports the use of barium sulfate as the default contrast agent for CT abdomen, pelvis studies.

In 1997 Quagliano studied the transit time by using three different barium sulfate formulations and one iodinated contrast agent. Quagliano found that all three barium sulfate suspension progressed farther through the digestive tract for given unit time than did the iodinated contrast

In 1997 Quagliano found that, the three barium maintained a reasonably contrast HU throughout the GI tract but when iodinated contrast is mixed with a flavored the HU attenuation in the stomach became (225-250HU) the contrast agent as it passes through the GI tract and water is absorbed. the HU of the iodinated contrast in the distal small bowel and colon was (350-450HU) this remaining in the bowel lumen decrease as water is absorbed and this leads to loss bowel distention, HU above 300 more light is transmitted from view box.

Finally Quagliano considered barium products is the most choise for obtaining excellent imaging characteristics, iodine products must be mixed with flavored drink and each iodinated contrast should be mixed immediately before administration

In 1998 lim dunham administers of oral contrast material to child under going abdominal CT for blunt trauma no evidence was found that administration oral contrast materials was harmful.

In 1998 jeffre j. Hebert ,etal, they had a research about the compression of colonic of transit between polyethylene Glycol and water as oral contrast vehicles in the CT evaluation of a cute appendicitis, forty patients have 1.600

ml of water iodinated contrast mixture (2ml/100ml water), delay time 2-2.5huors for having contrast, forty patients given new oral contrast mixture of 1000ml of polyethylenegycol (PEG) mixed with 30ml of iodinated contrast media agent the delay time of having it is 1 hour the test were reviewed for presence of contrast in the cecum and presence of appendicitis or other abdomen abnormality. the result, found that the thirty eight of 40 patients in PEG group had contrast medium in the colon at 1 hour after administration, 20 of where has surgically confirmed cases of appendicitis only 18 of the 40 pt who received the stander oral had contrast in cecum, 11 patient that confirmed appendicitis in this group and that lead to the used an oral contrast composed of PEG is better to trans it to the contrast to the colon even the pt with abdomen inflammation.

In 1999 McGonigal and Johnson, Stfford and Weiglet had research about oral contrast to the CT protocol for the evaluation of the patient with blunt abdominal trauma they were found that unnecessary of having oral contrast and delays time to scanning.

In 1999 Peter L. Choyke U.S to found that allergies can occur with any contrast agent whether injected or ingested orally. Allergies are more common with CT contrast media especially iodinated contrast media can damage the kidneys which is known as a contrast nephrotoxity.

In 2003 also Chayke found that some centers use water as oral contrast. this is an acceptable alternative oral contrast since it hydrates the patient and also provides a negative contrast.

In 2007 Chi Wan Koo had a research about Milk may outperform GIT contrast, 215 patients for doing CT abdomen pelvis, all of them had contrast, 100 of them had 0.1% barium and 115 patient were given whole milk researcher reviewed all images based on degree of bowel wall visibility and also the cost of contrast. the results of research is found there is no different between the two contrast whole milk and barium regarding the degree of

bowel distention and mural visualization for all segments of bowel studies, more patients found milk pleasant in taste. adverse side effect included abdominal discomfort, craming, nausea, and diarrhea.

In 2008 a team of physicians from Johns Hop Kins Medical, low osmolar contrast media (LOCM)such as GE Healthcares Omnipaque (iohexol). Make effective oral contrast agent for abdominal CT scans, due to many reasons non-absorbable and low risk to the patient if aspirated, it is water-soluble and low viscosity which permits uniform distribution. it does not precipitate out of the solution it is inert and can readily and completely eliminated. it is almost tasteless and well tolerated by patient.

In the other hand about High Osmolar Contrast Media(HOCM) draws a large amount of water from blood and body tissue into the intestinal lumen that result in dehydration, especially in infants also result in undesired dilution of contrast agent, if aspirated cause pulmonary edema, also mild-sever GIT complains such as (nausea, vomiting cramps and diarrhea) especially in high concentrations. in the same research founded about omnipaque select safety information. if orally administered hypertonic contrast draw fluid into intestines which if could result in hypoyolemia, plasma fluid loss lead to a shock, there for using dilute, hypotonic solution for ct examination

Chapter Three

Materials and Methods

Chapter Three

Material and Method

3-1 Materials

3-1-1 subject

3-1-1-1 Study population

Study sample was consisted of (60) patients with abdominal pain or patient that suspected of bowel pathology at ALMOALEM HOSPITAL for negative oral contrast (mannitol)and ASIA HOSITAL for positive oral contrast media(omnipaque). .

3-1-1-2 inclusion criteria

the study include patient that suspected abdomen pathology at age between (7-90 years), with different gendar.

3-1-1-3 exclusion criteria

patients with Allergy to contrast agent, pregnancy, renal failure were excluded from this study

3-1-2 Machine:

The study was executed using multi-detector computed tomography scanner MDCT 128 slice VITREA SYSTEM TOSHIBA 0.625mm collimation, table feed 10mm/rotation. effective tube current 685mAs at 120kV.Pitch=10/40mm collimation =.25.average scan time =5s with fan beam shape. CT monitor for controlling scanning and processing for contrast injection Medrao Toshiba-2ways for flush contrast media to patient and PACS system for diagnosis images and reconstruction(this modalities to detect negative coral contrast media (mannitol) AND MDCT general electric(GE)system HEALTHCARE 16slice 0.2625mm collimation, table feed 5 mm/rotation.effective tube current 300mAs at 12kV pitch 0.8 average scan time 10s CT monitor for controlling scanning and processing contrast

injector MED(TRON for I V contrast media injection FOR positive oral contrast media(omnipaque).

3-2 Methods

3-2-1 protocol

In 60 patients (male.., female.., mean age) were included MDCT was preformed. Each patient drunk oral contrast media out of scan room as long drink than short drink on scan room on the table of the exam, patient spend about 40 min as long drink. After that take short drink patient lye supine and also instructed to hold breathing . for patient's preparation patient instructed to be fasting for at least 6hours before exam this for patient under gone examination with negative oral contrast media AND for patient whom examined with positive oral contrast media prepared 24 hours before exam by castor oil (to evacuate GIT) and disflytel tabs to absorb gases, also patient instructed to far away from foods that having oil component and milk components in order to evacuate intestine from fecal masses and abdominal gasses that may interface with bowel pathology or bowel wall pathology and affect image quality, lastly 5mm cuts was preformed just above the base of the lung to the symphysis pubic in order to included any abdominal diseases.

3-2-2 Method of data collection

The data were collect on master data sheet from the diagnostic stations which was include all parameters need for evaluations, (Patient gender, age, patient preparation, amount of oral, patient complication, bowel wall appearance, lumen appearance and time of oral intake).

3-2-3 Method of data analysis

comparative analytical method was done using SPSS statistical program based on descriptive statistics and comparative associational hypothesis tests (0.05 sig. level).

3-2-4 Ethical issues

1-There was official written permission to Khartoum state diagnostic centers to take the data

2-No patient data were published also the data was kept in personal computer

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Chapter Four

Results

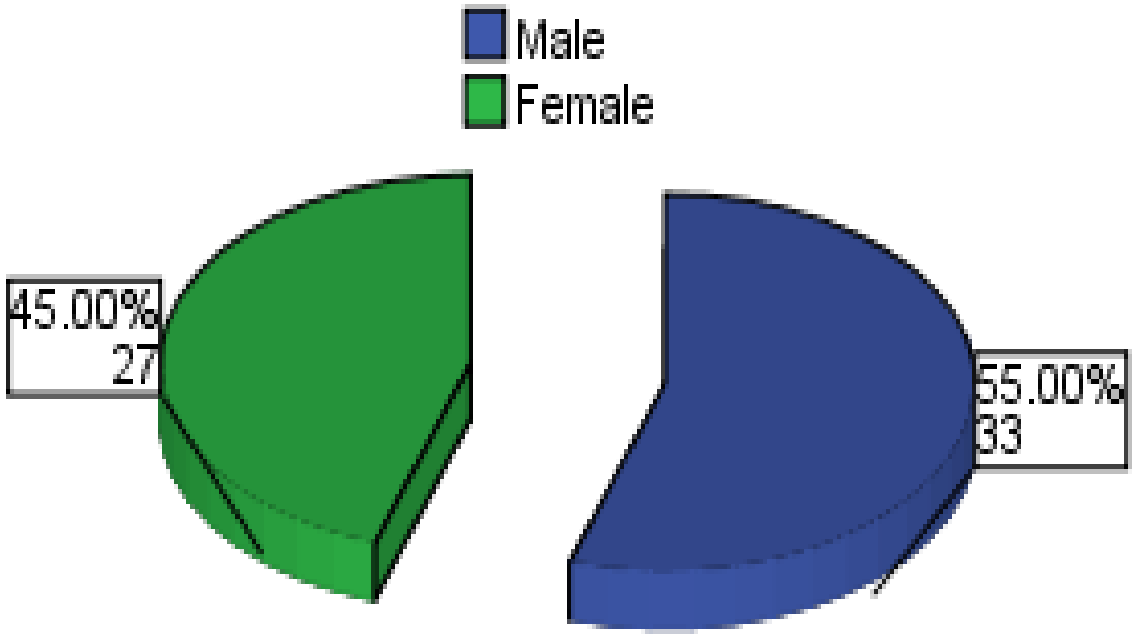
Chapter Four

The Result

Statistical Methods: comparative analytical method was used, using SPSS statistical program based on descriptive statistics and comparative associational hypothesis tests (0.05 sig. level).

Table (4.1) Participants distribution with respect gender:

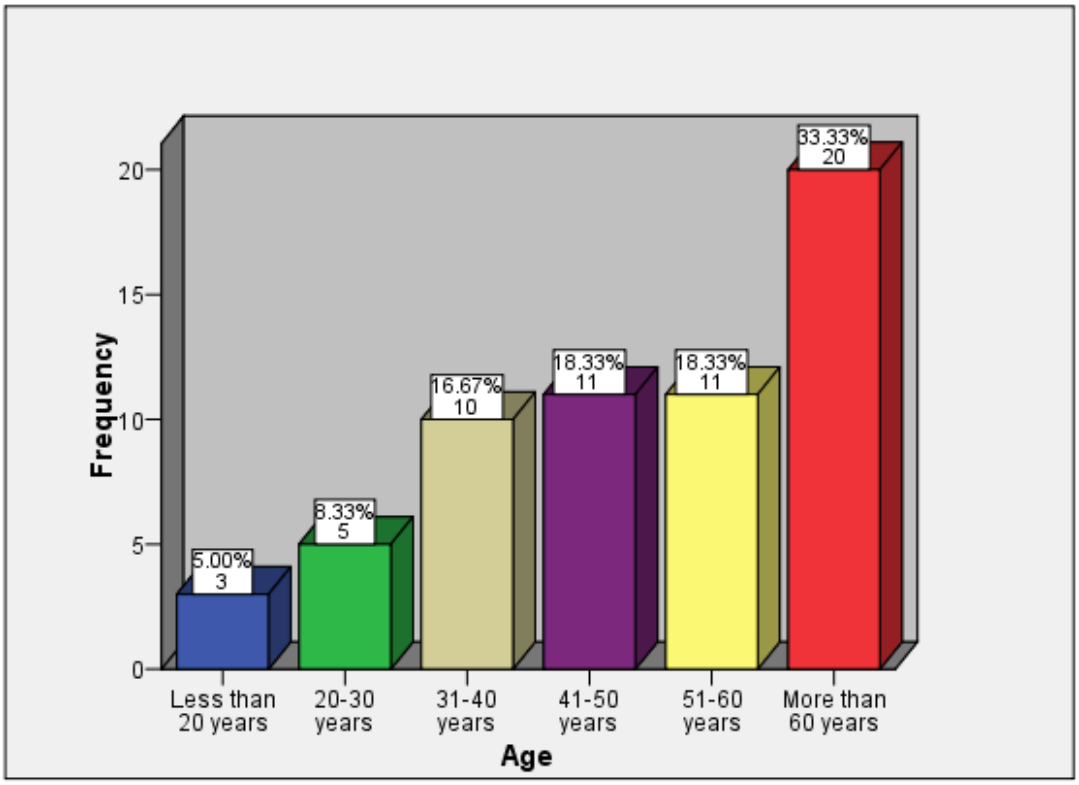
Gender	**Frequency**	**Percent**
Male	33	55.0
Female	27	45.0
Total	**60**	**100.0**



Fig(4. 1) distribution of participants according to gender

Table (4.2) Participants distribution with respect to age:

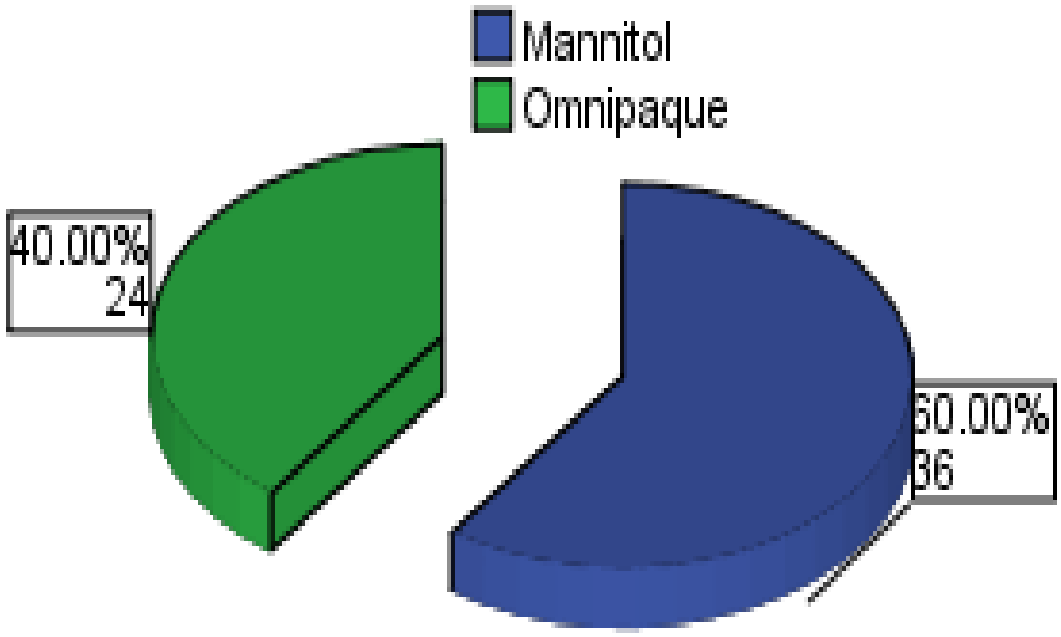
Age	Frequency	Percent
Less than 20 years	3	5.0
20-30 years	5	8.3
31-40 years	10	16.7
41-50 years	11	18.3
51-60 years	11	18.3
More than 60 years	20	33.4
Total	**60**	**100.0**



Fig(4. 2) Participants distribution with respect to age

Table (4.3) Participants distribution with respect oral media intake:

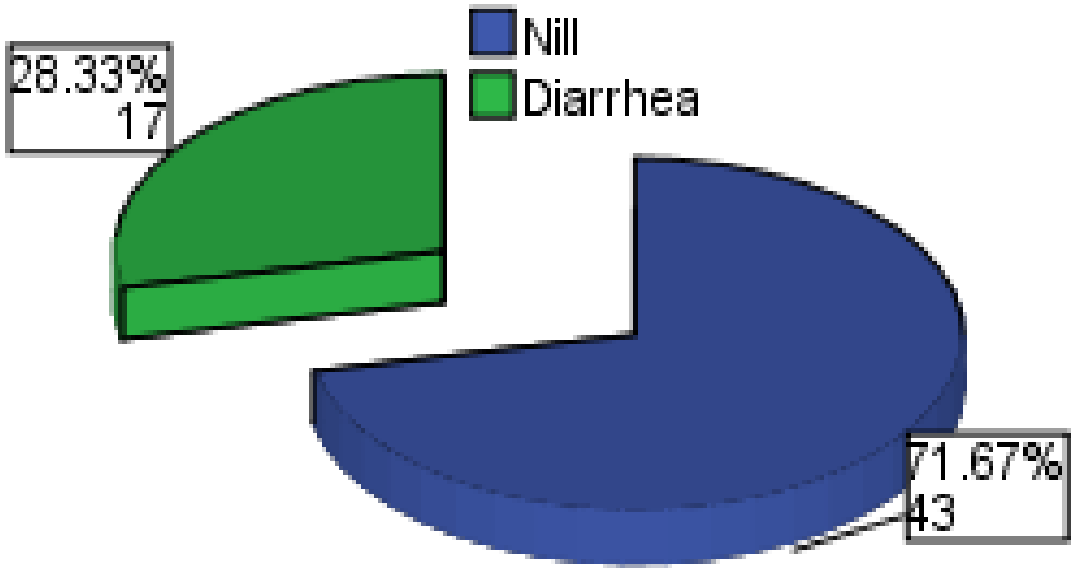
Media	**Frequency**	**Percent**
Mannitol	36	60.0
Omnipaque	24	40.0
Total	60	100.0



Fig(4. 3) distribution of participants according to oral media intake

Table (4.4) Participants distribution with respect to complication correspondent to mannitol as oral contras media:

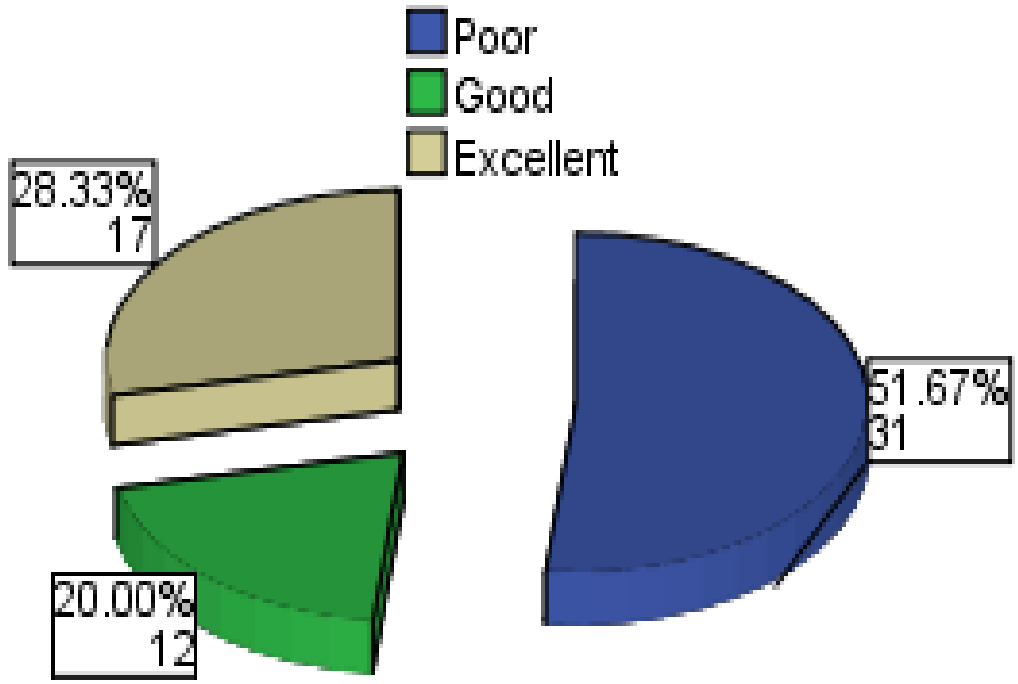
complication	**Frequency**	**Percent**
Nell	43	71.7
Diarrhea	17	28.3
Total	**60**	**100.0**



Fig(4. 4) distribution of participants according to complication correspondent to mannitol as oral contrast media

Table (4.5) Participants distribution with respect to bowel wall appearance:

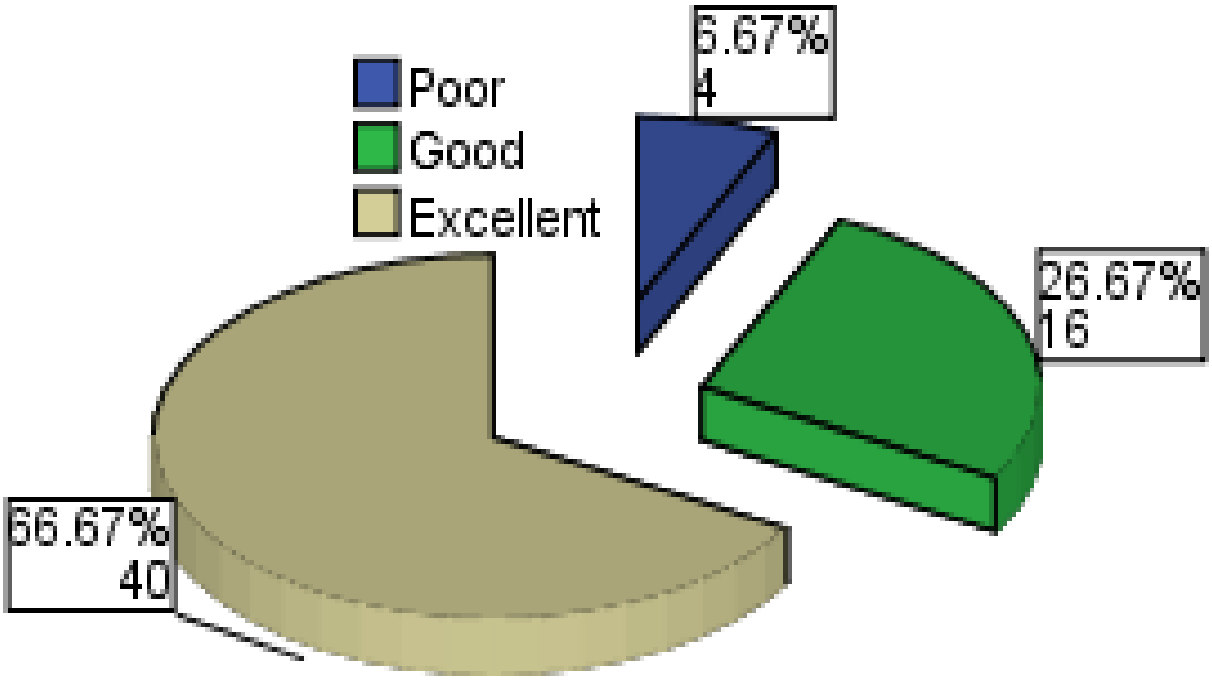
Bowel wall appearance	**Frequency**	**Percent**
Poor	31	51.7
Good	12	20.0
Excellent	17	28.3
Total	**60**	**100.0**



Fig(4. 5) distribution of participants according to bowel wall appearance

Table (4.6) Participants distribution with respect to lumen appearance:

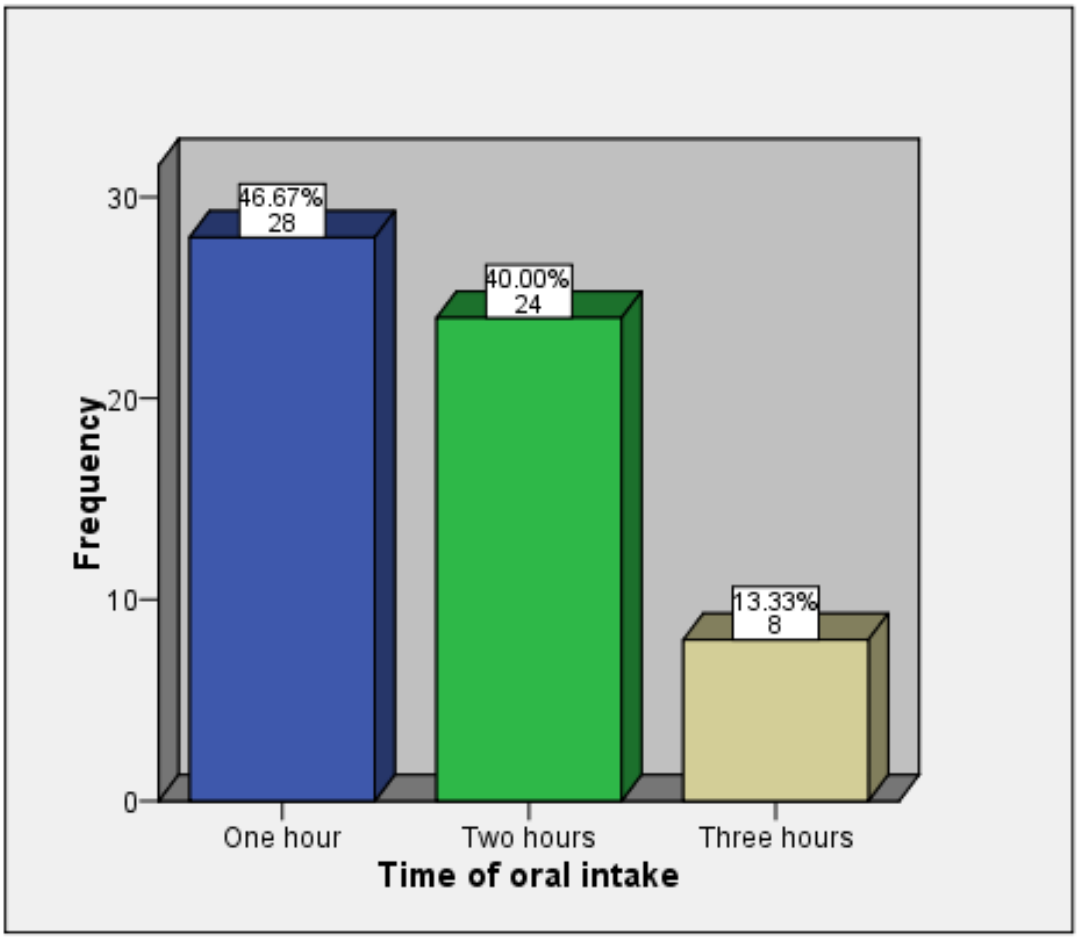
Lumen appearance	**Frequency**	**Percent**
Poor	4	6.7
Good	16	26.7
Excellent	40	66.6
Total	**60**	**100.0**



Fig(4. 6) distribution of participants according to lumen appearance

Table (4.7) Participants distribution with respect to time of oral intake:

Time of oral intake	**Frequency**	**Percent**
One hour	28	46.7
Two hours	24	40.0
Three hours	8	13.3
Total	**60**	**100.0**



Fig(4. 7) distribution of participants according to time of oral intake

Table (4.8) Chi-square test for association of lumen appearance and oral media:

		Lumen appearance			
Media		Poor	Good	Excellent	Total
Mannitol	Count	3	12	21	36
	%	8.3%	33.3%	58.3%	100.0%
Omnipaque	Count	1	4	19	24
	%	4.2%	16.7%	79.2%	100.0%
Total	Count	4	16	40	60
	%	6.7%	26.7%	66.7%	100.0%
Chi-Square Tests					
		Value	df	Sig. (2-sided)	
Likelihood Ratio		2.916	2	0.233	

Table (4.9) Chi-square test for association of bowel wall appearance and oral media:

		Bowel wall appearance			
Media		Poor	Good	Excellent	Total
Mannitol	Count	7	12	17	36
	%	19.4%	33.3%	47.2%	100.0%
Omnipaque	Count	24	0	0	24
	%	100.0%	0.0%	0.0%	100.0%
Total	Count	31	12	17	60
	%	51.7%	20.0%	28.3%	100.0%

Chi-Square Tests			
	Value	df	Sig. (2-sided)
Likelihood Ratio	47.644	2	0.000

Table (4.10) Chi-square test for association of lumen appearance and time of oral intake:

		Lumen appearance			
		Poor	Good	Excellent	Total
One hour	Count	0	2	26	28
	%	0.0%	7.1%	92.9%	100.0%
Two hours	Count	1	13	10	24
	%	4.2%	54.2%	41.7%	100.0%
Three hours	Count	3	1	4	8
	%	37.5%	12.5%	50.0%	100.0%
Total	Count	4	16	40	60
	%	6.7%	26.7%	66.7%	100.0%

Chi-Square Tests

	Value	df	Sig. (2-sided)
Likelihood Ratio	26.593	4	0.000

Table (4.11) Chi-square test for association of bowel wall appearance and time of oral intake:

		Bowel wall appearance			
		Poor	Good	Excellent	Total
One hour	Count	13	1	14	28
	%	46.4%	3.6%	50.0%	100.0%
Two hours	Count	13	8	3	24
	%	54.2%	33.3%	12.5%	100.0%
Three hours	Count	5	3	0	8
	%	62.5%	37.5%	.0%	100.0%
Total	Count	31	12	17	60
	%	51.7%	20.0%	28.3%	100.0%

Chi-Square Tests

	Value	df	Sig. (2-sided)
Likelihood Ratio	19.846	4	0.001

Table (4.12) Chi-square test for association of complications and oral media:

		complication		
Media		Nell	Diarrhea	Total
Mannitol	Count	19	17	36
	%	52.8%	47.2%	100.0%
Omnipaque	Count	24	0	24
	%	100.0%	0.0%	100.0%
Total	Count	43	17	60
	%	71.7%	28.3%	100.0%

Chi-Square Tests

	Value	df	Sig. (2-sided)
Likelihood Ratio	21.733	1	0.000

Chapter Five

Discussion, Conclusion and Recommendations

Chapter Five

Discussion, Conclusion and Recommendation

5.1 Discussion:

This study was aimed to evaluate the role of oral contrast used in computed tomography in the diagnosis of abdominal pathology and to evaluate type, time and complications.

In the present cases coming for CT abdomen to CT center table (1) shows that the proportion of males to females was 55% to 45% the proportion of males is greater than females. table (2) show the variation of the age as 33% of the participants were more than 60 years old, since 18.3 of them were 41-50 years or 51-60 years and 16.7% of them 31-40 years, while 8.3%of them 20-30 old and only 5% were less than 20 years old. Therefore, most of the participants were (more than 30 years old). table (3) showed the distribution of oral contrast intake 60% of patients took mannitol(negative oral contrast media), while 40% of them took omnipaque (positive oral contrast media). table (4) showed that the complications. of mannitol most (71.7%) of participants didn't complain, while (28.3%) of them had diarrhea as complication correspondent to mannitol oral contrast media this is similler to Dr.Peter L.Choyke found that the allerge to contrast can occur with any contrast agent, also contrast media especially iodinated contrast media can damage the kidneys which is known as a contrast nephrotoxity.

also this result congruence with the result of Dr.Chi.Wan Koo which found that adverse side effect included abdominal discomfort, craming, nausea, and diarrhea. therefor ateam of physician from jhons hop kin medical found that mild-sever GIT complains such as (nausea, vomiting cramps and diarrhea) especially in high concentrations in the same research founded about omnipaque select safety information. if orally administered hypertonic contrast draw fluid into intestines which if could result in hypoyolemia,

plasma fluid loss lead to a shock, there for using dilute, hypotonic solution for ct examination.

table (5) shows that bowel wall appearance for most (51.7%) of participants was poor, since for (20%) of them was good, while for (28.3%) of them was excellent bowel wall appearance.

table (6) mentioned the bowel wall appearance for most (66.6%) of participants was excellent, since for (26.7%) of them was good, while for only (6.7%) of them was poor bowel wall appearance. That was agreed by the research of chi wan koo the results of research is found there is no different between the two contrast whole milk and barium regarding the degree of bowel distention and mural visualization for all segments of bowel studies, more patient found milk pleasant in taste. table (7) showed the distribution of time according to oral intake (46.7%) of participants took only an hour in oral media, since (40%) of them took two hours, while only (13.3%) of them took three hours. table (8) shows that lumen appearance does not depend on media. This is same as the research of chi wan koo the results of research is found there is no different between the two contrast whole milk and barium regarding the degree of bowel distention and mural visualization for all segments of bowel studies, more patients found milk pleasant in taste . table (9) showed that the bowel wall appearance for how responded positive. oral contrast media was poor also bowel wall appearance depends on media. table (10) found that lumen appearance for who spent only one hour was excellent and lumen gradually disappears as time of oral intake increases.table (11) shows that the probability of bowel wall appearance is irrvespective to time oral intake gradually disappears as time of oral intake increases. table (12) mentioned that all (100%) of participants who responded posative contrast oral media didn’t have any complications, while most (65%) of who responded nagative contrast oral media were have diarrhea and differences in “complications” are related to oral media is

supported and nagaitive contrast oral media is more complicate than positive contrast oral media.

5.2 Conclusion

From the above results the study found that for bowel wall pathology the best oral contrast media is mannitol, also for lumen pathology each oral contrast is better, the time for good image details is one hour for fully distended of the abdomen and avoided dehydration of the patients .

using of mannitol sometimes lead for patient complications like diarrhea .

5.3 Recommendations

According to results, the researcher recommended

1. The time of administration of oral contrast must being short.
2. The type of oral must be used depending on patient condition
3. Further research to evaluate the accuracy of water as oral contrast media
4. Further studies be as the same by larger volume of patients

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Appendices

Appendix (I) Data sheet

Pt name	age	gender	Pt prep	Amount of oral ml	Pt complications	Bowel wall appearance poor	good	Excellent	Lumen appearance poor	good	excellent	Time of oral intake 1hur	2hurs	3hurs

Appendix (II) CT images

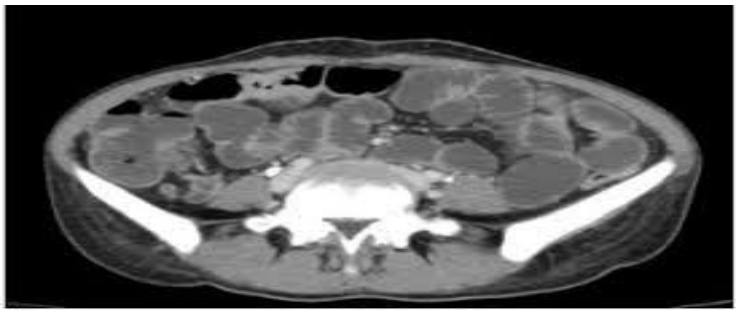


Image (1) patient with 45 age, image showing mural fold visibility in mannitol

Image (2) coronal CT image for male 24 age with abdomenal pain .

Image (3) Computed tomography (CT) scan of an obstructed appendix shown lengthwise cutts with omnipaque .

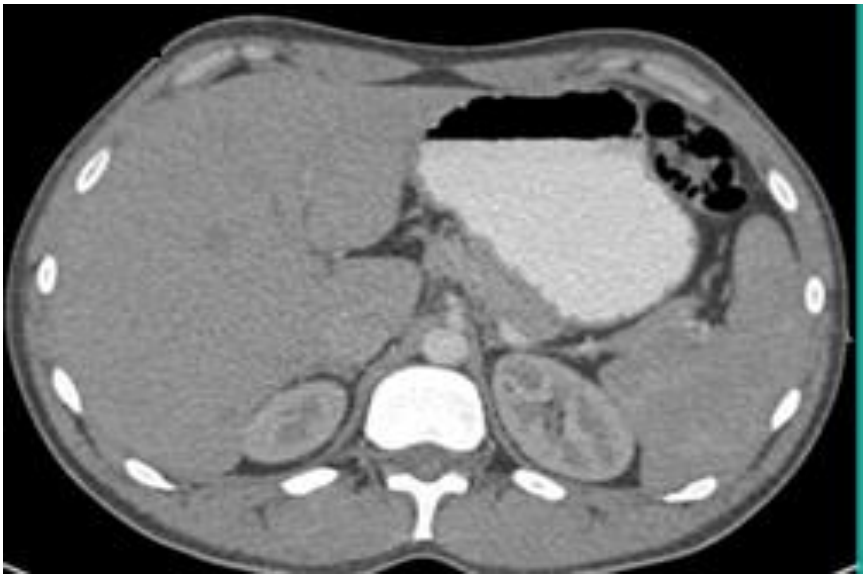


Image (4) CT of female 52 age normal with oral contrast

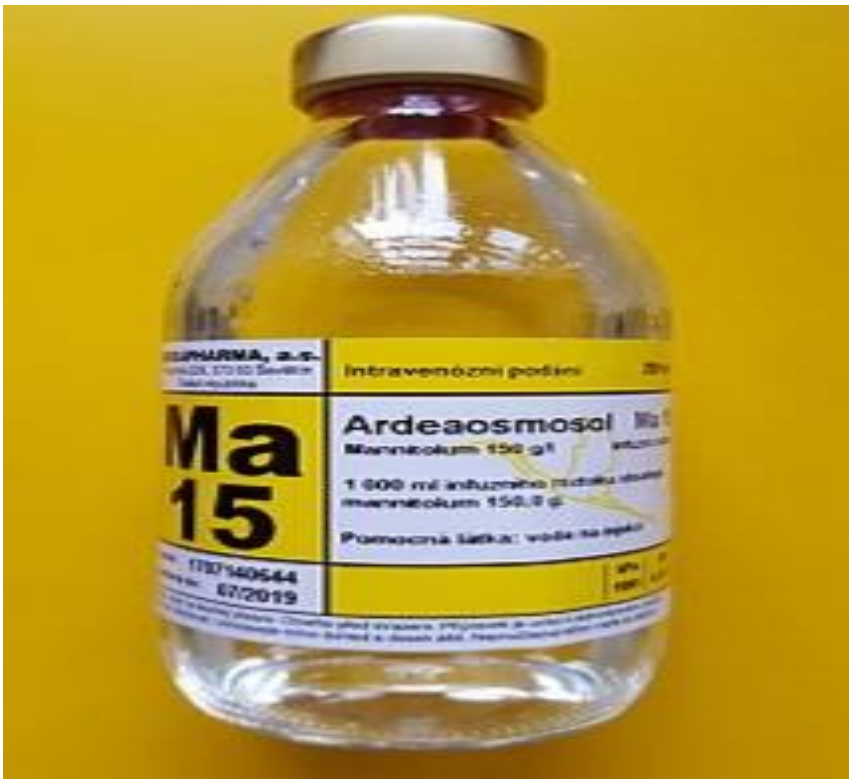
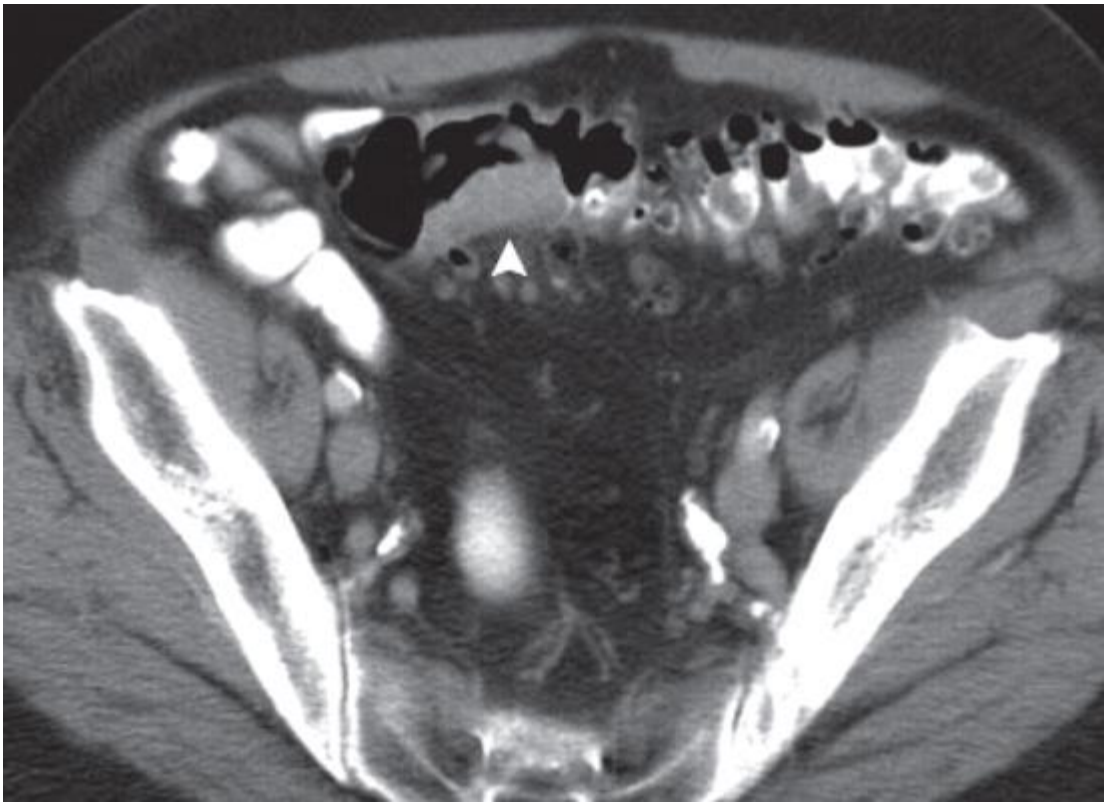


Image (5) Mannitol 15% solution for intravenous and oral uses

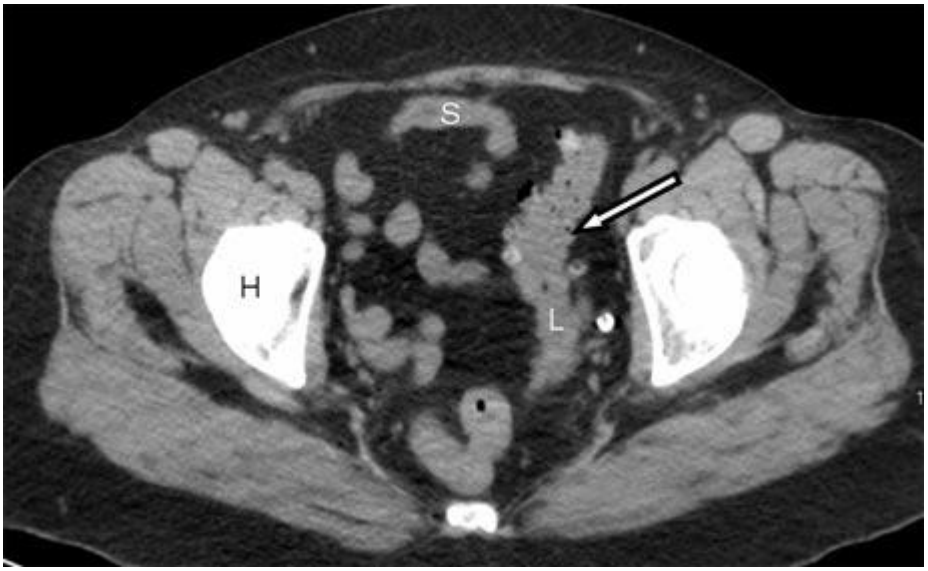
Image (6) omnipaque oral and intravenous contrast media

Coronal computed tomography (CT) scan of a pediatric patient with acute appendicitis and appendicolith (inflammation of the appendix) showing a calcified (hardened) lesion (arrows).

A - Acute appendicitis



Computed tomography (CT) scan of the colon showing a large mass (arrowhead).



The arrow points to one of many diverticula (outpouchings) from the colon. The inner surface of the intestines (bowels) is not visible unless the patient has drunk oral contrast (dye).

L = Large intestine (colon)

S = Small intestine

H = Hip joint bone

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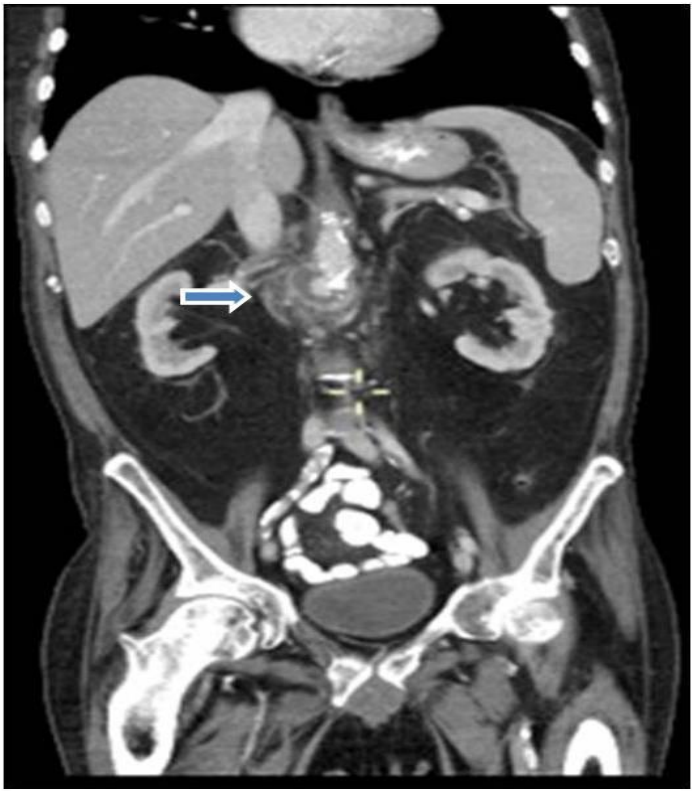

CT of the abdomen and pelvis using PO and IV contrast. A reformatted 5-mm coronal image is shown. A 66-year-old male presented with a history of coronary artery disease, chronic renal insufficiency, ostomyelitis of the foot, and 6 days of constant abdominal pain. Contrast is seen extending beyond the calcified abdominal aortic lumen at, and below, the level of the origin of the renal arteries, with a contained saccular portion measuring 3.4 X 1.7 X 2.7 cm (representing a pseudoaneurysm or a contained dissection secondary to an atherosclerotic ulcer). The patient's condition worsened, and he had MRSA sepsis. At surgery a mycotic aneurysm was found.

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