



**Faculty of Medicine
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Post graduate**

SACROCOCCYGEAL TERATOMAS

Essay

For partial fulfillment of MSc in General Surgery

Investigator

Ashraf Mahmoud safwat Abd El Hamid

SUPERVISORS

PROF.

Adel Taha Dinewer

Professor and head of unit of surgical oncology
Faculty of Medicine –Mansoura university

PROF.

Nazem Mohamed Ali Shams

Professor of surgical oncology
Faculty of Medicine –Mansoura university

Dr. Mohammed Abd El Fattah Hegazy

Lecturer of Surgical oncology
Faculty of medicine –Mansoura university

Main Supervisor

PROF. Adel Taha Dinewer

Professor and head of unit of surgical oncology
Faculty of Medicine –Mansoura university

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INTRODUCTION AND AIM OF THE WORK

Sacrococcygeal teratoma is a neoplasm composed of wide diversity from all three layer foreign to the anatomical site which it arise .The name is derived from Greek word (teratos) which literally means monster ,the ending oma means neoplasm. They are always found in children and frequently in gonads.

The cuneiform table of the chaldeans of about 2000 BC described what appeared to have been a Sacrococcygeal teratoma ,they refer to a baby born with three legs ,two normal ones and one in between the two normal extremities (Ein et., al 1980) .This may have been an example of incomplete twins , of which there are numerous of the antique and medieval literature .

The first exact description of the Sacrococcygeal teratoma in an infant was given by Saxtoph and Duvigneau in 1970 (Flake et., al 1986) .Stanley reported first successful operation in 1841 .The first to postulate the modern view on the etiology of this tumour was Steinmann in the doctorate thesis of 1905 .

According to the distribution of neonatal teratoma in children's cancer group neonatal cancer survey , the number of sacrococcygeal teratoma (126) , cervical teratoma (14), cranio facial (6) , retroperitoneal (3) , mediastinal (1)

Germ cell tumors (GCTS) account for approximately 3 per cent of childhood malignancies. The true incidence is difficult to ascertain, as many of the benign GCTs will not be registered with central cancer registries. However, the incidence of malignant GCTs in children is rising (Mann 2002).

In 1981 -90 the age-standardized rates of germ cell and gonadal neoplasm were 4.2 per million per year for England and Wales and 4.8 for Scotland.(Parkin et al 1998). Two-thirds of GCTs in children occur in extragonadal sites and the incidence of the commonest GCT, sacrococcygeal teratoma, is 1 in 40000 live births (table 1). Epidemiological studies have shown a bimodal age distribution with one peak in children under 3 years of age and a second peak after 12 years of age.

The early peak reflects the incidence of sacrococcygeal tumors and yolk sac tumour of the testis, the latter GCTs of the ovary, testis and intracranial sites. It is of interest that the sacrococcygeal teratomas are commonly found in females, whereas those in the gastric, mediastinal and central nervous systems more often affect males.

Black children have low mortality rates from testicular tumors, whereas pineal teratomas are more common in Japan than in western countries. GCTs of the gonads, pineal and sacrococcygeal regions may be familial and or associated with a variety of malformations.(Fraumeni et., al 1968). For example, sacrococcygeal teratoma may occur with sacral agenesis, meningocele or anomalies of the genitourinary tract and hind gut.

Gonadoblastoma and malignant GCTs occur in the gonads of individuals with intersex states , especially gonadal dysgenesis and a y chromosome or 46xy/45xo mosaicism. (Krasna et., al 1992). Boys with undescended testes have an increased risk of testicular cancer and mediastinal tumors occur in

Klinefelter's syndrome .

Aim of the work

To review sacrococcygeal teratomas with special emphasis on their pathogenesis and , intra uterine diagnosis and Management, post natal diagnostic work up and surgical treatment.

PATHOLOGY

Types

Sacrococcygeal teratomas may be classified as benign (mature) and malignant or immature (composed of embryonic elements).(keslar et al 1994) . Mature teratomas are most common in neonates (68%) and older children (73%) . Immature teratomas are cystic, whereas malignant tumours are solid. Over 50% of sacrococcygeal teratomas have calcification and ossification .(keslar et al 1994) reported that 69(62%) of the 96 sacrococcygeal teratomas in their series were composed of both solid and cystic elements . The cysts may be filled with serous fluid, mucoid, or sebaceous material and lined by true epithelium. Ein et al found cystic tumour that were filled with cerebrospinal fluid from choroids plexus present in the tumour mass. (Ein et., al 1985) . Virtually any tissue can be present in a sacrococcygeal teratoma. (juric et., al 1993) . Neuroglial tissue fig (1), skin, respiratory and enteric epithelium, cartilage, smooth muscle, and striated muscle are the most common elements found , fig(2) . Bone, pancreatic tissue, choroids plexus, and adrenal tissues are less commonly identified.(Valdisserri et., al 1981) . An ocular lens present as lentinoids (lens – like cells), as well as a completely formed eye, have been found within sacrococcygeal teratomas, (Consolato et., al 1999) . (Parizek et., al 1992) reported a mature teratoma containing the lower half of a human body in one of fraternal twins.

The majority of teratomas in infancy and childhood are benign . in a review of 68 cases at the children's hospital of pittsburgh between 1946 and 1979, 75% were benign, 11.8% immature, and 13.2% malignant. seventy-three cases gathered by Schropp et al. reborted 22% malignant and 78% benign histology (Schropp et., al 1992). among the pediatric population,

there is a tendency toward development of malignant teratoma with increasing age.

However in case reports or small series involving adult patients . benign tumors predominate . All 11 patients reported by miles and Stewart had benign tumors . as did 23 of 24 cases he gathered from the literature published in English from 1952 through 1973 . other authors reported similar observations of the predominance of benign Teratomas in adults (Ahmed et., al 1985).

Size

Size of a sacrococcygeal teratoma (average 8 cm, range 1 to 30 cm) does not predict its biological behavior. (keslar et., al 1994) . Altman et al have defined the size of sacrococcygeal teratomas as follows ; small, 2 to 5 cm diameter; moderate, 5 to 10 cm diameter; large,> 10 cm diameter(Altman et., al 1974) .

Site

The sacrococcygeal region is the most common location. Less common sites are the mediastinum, testes, retroperitoneum, brain, head and neck, vagina, stomach, and pineal region. (Brinker et., al 1989) . Sacrococcygeal teratomas may continue to grow posteriorly to form an external protrusion, or dissect anteriorly, distorting regional organs (rectum, vagina, and bladder) without invading them .

Extent

The American academy of pediatrics. Surgical section (APPSS) classification helps in grading the extent of sacrococcygeal teratomas, as follows (Murphy et., al 1992) .

Type 1 – predominantly external with minimal presacral component .

Type II – present externally but with significant intrapelvic extension.

Type III – apparent externally but predominantly a pelvic mass extending into the abdomen.

Type IV – presacral with no external presentation.

Histology

Sacrococcygeal teratomas are graded histologically as follows.(Graf et., al 1998) .

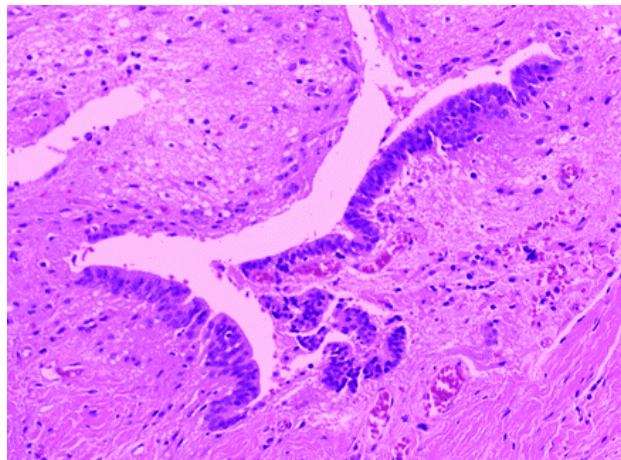
Grade 0 - tumour contains only mature tissue

Grade 1 - tumour contains rare foci of immature tissues

Grade 2 - tumour contains moderate quantities of immature tissues

Grade 3 - tumour contains large quantities of immature tissue with or without malignant yolk sac elements.

Grading of Sacrococcygeal teratomas, unlike that of ovarian teratomas, does not seem to correlate directly with prognosis.



Fig(1) Photomicrograph (original magnification, x200; H-E stain) of the resented specimen shows a small amount of immature neural tissue.

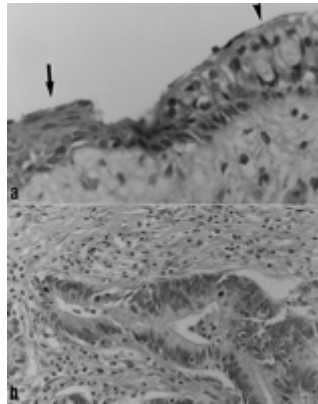


Fig (2) Photomicrographs (haematoxylin-eosin stain, original magnification (a) x40; (b) x20) show (a) the wall of the cyst composed of fibrous tissue with an inner lining of mature squamous epithelium and respiratory epithelium, and (b) irregular nests of moderately differentiated adenocarcinomatous glands infiltrating the surrounding stroma.

Associated malformations

The incidence of various congenital malformations associated with Sacrococcygeal teratoma ranges from 5% to 26% (Gross et., al 1951) of these, anorectal and genital malformations are of prime concern. The association of Sacrococcygeal teratoma with anorectal malformations was described as early as 1935 (Subbarao et., al 1994) . During the third week of embryonic life , genital folds unite to form the genital tubercle by migration of mesenchymal cells from the primitive streak region around the cloacal membrane. During the fourth and seventh weeks, the cloaca is subdivided by the urorectal septum to form the anorectal canal and the primitive urogenital sinus. A growing Sacrococcygeal teratoma cloacal membrane and prevent descent and fusion of the urorectal septum to the cloacal membrane, resulting in a high anorectal malformantion with a rectourethral fistula. An result in the absence of rectum and anus. The physical presence of teratoma could also prebifid scrotum and hypospadias.

Other associated anomalies include spinal dysraphism, sacral agenesis, dislocation of the hips caused by a large tumour, and meningocele. Rarely cardiac anomalies such as a ventricular septal defect or gastrointestinal anomalies other than imperforate anus have been described. Vogl and Riel reported a case with anorectal malformation, sacral dysplasia, and a presacral mass (currarino's triad) . (lahdenne et., al 1991) reported vertebral abnormalities in 80% of their 45 patients with benign sacrococcygeal teratoma.

CLINICAL PICTURE

Sacrococcygeal teratomas have been diagnosed before birth by fetal ultrasonographic examination (Sherowsky et al 1985). Prenatal diagnosis is important because these tumors may be large enough to cause dystocia. Rupture of the tumor with massive hemorrhage may occur during birth. Thus, it is important to have the mother delivered by cesarean section in centre where the infant can receive immediate surgical treatment.

Unfortunately, sacrococcygeal teratomas that appear before 30 weeks gestation are associated with polyhydramnios and placentomegally. In well over half of the reported cases, skin-covered, firm or cystic mass. The mass may weigh more than the infant or be no more than a barely noticeable lump.

The larger masses often distort and push the anus anteriorly. A large presacral extension may compress pelvic veins, causing leg edema. In addition, presacral tumor may obstruct the bladder, causing renal failure and vesical rupture. If there is intra abdominal extension, an abdominal mass can be palpated fig (4) .

The skin over large tumors is thin and may be discolored with haematoma and a network of blood vessels ,fig (3). Rarely, a teratoma is off to one side in a buttock. In older children, presacral teratomas can occur with constipation or non specific pelvic pain.

They may be no obvious external mass, but rectal examination will reveal a firm tumor, often fixed to the sacrum. Draining sinus tracts or repeated episodes of abscess formation posterior to the anus also suggest an undiagnosed teratoma. Ashcraft and Holder have reported an hereditary type of presacral teratoma associated with anal stenosis and

sacral defects, with an autosomal dominant pattern of inheritance. Bowel and urinary obstruction are often mentioned as a first sign of intrapelvic hidden malignant teratomas.



Fig (3) :Preoperative photographs show the massive sacrococcygeal tumor.

Urological manifestation of sacrococcygeal teratoma

Sacrococcygeal teratoma patients frequently exhibit urological signs and symptoms. A retrospective study was done of 29 patients, 6(21%) of whom presented with total urinary retention.

All cases of urinary retention appeared to be due to extrinsic

compression of the bladder outlet, which occurred in male as well as female patients.

Anterior and superior bladder displacement was noted in each case. Bladder wall trabeculation also often was presented which represent elevated intravesical pressure from bladder outlet obstruction.

Renal ultrasonography demonstrated moderate or severe hydronephrosis in 4 of the 6 patients with preoperative total urinary retention. The kidneys in these patients become ultrasonography normal within 3 months after tumor resection. Some believe that intravesical pressures may be persistently elevated even without total retention, thus, leading to hydronephrosis.

In light of the postoperative resolution of radiographic findings and the lack of urinary infections, proximal diversion with nephrostomy, vesicostomy or a suprapubic tube does not appear indicated.

Hydrocele occurred in 14% of the patients, which is greater than the reported incidence for this condition in the general population. There was 1 case of unilateral canicular cryptorchidism. The issue of urological abnormalities in large series of sacrococcygeal teratoma patients was adressed specifically.

Intradural extension of SCT

Intradural extension of a sacrococcygeal teratoma is extremely rare and only well-documented in presacral tumors that have been associated with a family history, anorectal stenosis, and sacral dysraphism.

Intrapelvic SCT

Intrapelvic sacrococcygeal teratoma rarely may be associated with anorectal malformation which lead to the initial misdiagnosis of Hirschsprung's disease.

Anterior sacral meningocele with sacrococcygeal teratoma.

Anterior sacral meningocele with sacrococcygeal teratoma is a rare entity. The cystic mass arising from anterior sacral and coccygeal defect, lies in the retrorectal space between the rectum and sacrum. It produces a variety of symptoms depending on its size and contents and constitutes a diagnostic problem.

Sacrococcygeal teratoma with placental vascular dissemination

The placental lesions could correspond either to metastases from undiagnosed foci of malignancy or to embolization of the tumor. The latter mechanism is suggested by chorionic localization of vascular thrombi and by lack of evidence of malignant foci in the teratoma and placental lesions. Metastases to the placenta from maternal or fetal neoplasms are usually confined to the intervillous space, and primary placental teratomas are localized between the chorion and the amnion (Yuen and Mincey 1987).

Maternal serum concentrations of AFP and hCG are usually normal during the first trimester in pregnancies complicated by fetal sacrococcygeal teratoma. High maternal serum levels of hCG have been reported previously in sacrococcygeal teratomas, without malignant transformation, presumably as a result of placental enlargement. Unfortunately, maternal serum levels of hCG were not obtained. As immunocytochemistry found no hCG-stained cells in the tumor or placental thrombi, the high serum concentration of hCG may be of placental origin (Kirkinen et.,al 1997) .

DIAGNOSIS

PRENATAL DIAGNOSIS SCT

There are substantial differences in the natural history of SCTs diagnosed postnatally versus those diagnosed prenatally. Those diagnosed prenatally by ultrasound may lead to reduced morbidity and mortality by a variety of mechanisms. Adverse clinical sequelae of a SCT can be subverted by prenatal diagnosis and appropriate obstetrical and perinatal management.

The most common index of suspicion leading to sonography for SCT is a uterus that is palpably too large for the gestational age of the fetus (Flake et.,al 1993). Enlargement is due to the large tumor mass or polyhydramnios, although the increase in amniotic fluid (in the absence of hydrops) is of unknown etiology.

The incidental detection of a SCT is increasing in asymptomatic mothers as more and more routine screening ultrasounds are performed at 16 to 20 weeks' gestation. A caudal and/or intraabdominal mass can be visualized as early as 13 weeks' gestation. Any such mass must be distinguished from other pelvic or sacral masses such as a rectal duplication cyst, myelomeningocele, meconium pseudocyst, mesenteric or ovarian cyst, neurentodermal cyst, and obstructive uropathy (Holzgreve et.,al 1985).

An SCT may be cystic, solid, or mixed and can have areas of calcification, hemorrhage, or necrosis. Its size and location may cause secondary effects such as bladder outlet obstruction, hydronephrosis, rectal atresia, sacral bony abnormality, placentomegaly, or fetal hydrops (Goto et., al 2000).

Table (2) . Anatomical grading system for newborn sacrococcygeal teratoma (SCT).

AAPSS	
type	SCT description
I	Tumor primarily external with minimal, if any, presacral component
II	Tumor primarily external, some presacral component
III	Tumor primarily presacral, small external component
IV	Tumor completely presacral, may extend into pelvis or abdomen

AAPSS: American Academy of Pediatrics Surgical Section (Altman et., al 1974).

Prenatally fatal pathophysiological consequences result from the development of hydrops secondary to high-output cardiac failure. The heart failure develops from a vascular "steal" or shunt phenomenon within the tumor. Predominantly solid tumors may be very vascular, with blood flow derived from the middle sacral artery and branches of the iliac arteries. The resistance in these vessels, compared to systemic and placental vessels, can be relatively low because the tumor may act as a large arteriovenous shunt (Langer et., al 1989).

If hydrops occurs and is untreated or treated when advanced, fetal mortality is virtually guaranteed (Flake et., al 1993).

The pathophysiological changes leading to fetal cardiac failure may be demonstrated by fetal echocardiography and dopplerultrasonography (Schmidt et.,al 1989). Cardiac failure is preceded by ventricular dilation, increased descending aortic blood flow, decreased placental flow via the umbilical artery, and dilation of the inferior vena cava. The shortening fraction is preserved until cardiac failure and hydrops ensue.

Advanced hydrops is heralded by placentomegaly. Prenatal hemorrhage into the tumor with resultant anemia may also cause high output cardiac failure and hydrops. If the fetus becomes hydropic and/or placentomegaly develops, the mother may develop an eclamptic-like illness termed the maternal mirror syndrome (Bond et., al 1990), consisting of

maternal hypertension, respiratory compromise, and renal impairment.

Delivery of the fetus and, most importantly, the placenta leads to resolution of the maternal illness. Interestingly, the development of fetal hydrops and placentomegaly may occur within a matter of days, often heralded by a sudden acceleration in growth of the tumor. Anecdotally, we have seen tumor growth of up to 1 cm/day, and frequently these SCTs become larger than the fetus.

Predominantly cystic tumors and/or those with little vascularity do not lead to hydrops (Westerburg et.,al 2000). However, perinatal morbidity may result from the mass effect of the SCT. Dystocia may occur and can result in traumatic tumor rupture and hemorrhage during labor and/or delivery (Garcia et.,al 1998). Prenatal diagnosis has its greatest role in the prevention of dystocia via planned, usually cesarean delivery for large tumors.

A large SCT, by virtue of its mass, can also cause preterm labor and delivery resulting in perinatal morbidity and mortality from complications of prematurity. These factors are responsible for a mortality rate of up to 52% for prenatally diagnosed SCTs . The clinical differences between prenatally and postnatally diagnosed SCTs are highlighted in Table 3.

Table (3) . Clinical differences between prenatally and postnatally diagnosed SCT.

Prenatally diagnosed	Postnatally diagnosed
Prognosis depends on physiology and size	Prognosis depends on location and histology
AAPSS classification not predictive of survival	AAPSS classification predicts survival
Tend to mature histologically	Tend toward malignancy over time
High mortality	Low mortality

Prenatal diagnosis of sacrococcygeal teratoma with constitutional partial monosomy 7q/trisomy 2p.

The central university hospital (Nates France 2003) report prenatal diagnosis of a fetus with sacrococcygeal teratoma and facial dysmorphism attributed to a constitutional terminal deletion of chromosome 7q and partial trisomy of chromosome 2p likely resulting from a de novo balanced translocation. The cytogenetic abnormality was diagnosed prenatally after sonographic detection of teratoma and confirmed on peripheral blood cells at birth. The newborn died of post-operative complications at seven days of age.

FISH analysis demonstrated haploinsufficiency of HLXB9, a gene identified in the triad of a presacral mass (teratoma or anterior meningocele), sacral agenesis, and anorectal malformation, which constitutes the Currarino syndrome. Despite the absence of other features of the triad, the teratoma observed in the fetus they describe might represent a partial form of Currarino syndrome.



Fig (4) Type II sacrococcygeal teratoma. Clinical photograph of an infant shows an obvious external mass. Preoperative work-up showed that the tumor extended into the presacral space.

DIFFERENTIAL DIAGNOSIS

The great majority of sacrococcygeal tumors presenting at birth can be diagnosed without any difficulty. Problems of diagnosis are most likely to arise with comparative small lesions and with all many types III and IV.

Sacral myelomeningocele

Typically a myelomeningocele is membrane covered, situated at a higher level than a sacrococcygeal teratoma and associated with neurological deficit. The distinction can be more difficult if the lesion is skin covered.

A simple clinical test is to press on the tumor ; if the anterior fontanelle does not become distended the most likely diagnosis is sacrococcygeal teratoma (Dillard et., al 1970). The most important clue ,however, is the fact that teratomas tend to displace the anus forwards: A lipomeningocele can present more difficulty but still also lies at a higher level, and in addition is a less circumscribed mass.

Anterior myelomeningoceles are extremely rare; on clinical grounds the distinction from an Altmann type IV teratoma would be difficult ; hence the value of CT scanning in such situations, especially in the neonate in whom radiological assessment of the sacrum may be difficult (Izant and Filston 1975) .

Chordoma

Chordoma, arising from remnants of the notochord, is very rare in newborn infants. It can occur anywhere along the spinal axis but is most common in the sacrococcygeal region (Richards et ., al 1973). These tumors are typically situated in front of the sacrum, usually destroy bone and infiltrate into the spinal canal.

In the only case which have seen in a newborn this was not the case

and, apart from the fact the anus was not displaced forwards, the clinical characteristics appeared to be identical with those of a teratoma.

Other rare conditions which may present a similar clinical appearance are sacral lipoma (associated with spina bifida) and giant neurofibroma. Presacral (type IV) sacrococcygeal teratoma presents a greater diagnostic dilemma. Anterior meningoceles and rectal duplication cysts will produce identical clinical features and must be considered in the differential diagnosis of any presacral mass. Dermoid cysts and rare tumours such as chordomas or haemangiomas may also arise in the presacral hollow.

RADIOLOGY / IMAGING

Plain X ray

Anteroposterior and lateral radiographs of pelvis and spine are taken routinely. Calcification is seen frequently and may be diffuse or in the form of recognizable structures, such as incompletely formed bones, or tooth buds ; it was recorded in 44% of the cases. Calcification is a feature of both benign and malignant lesions but is less common in the malignant lesions (Jones et., al 1993).

The sacral spine is usually normal but may show developmental defects or destructive lesion(Ashcraft and Holder 1974). Concave defect of the back of vertebral bodies and neural arch defects are highly suggestive of intraspinal extension, but this is an unlikely finding in neonatal cases.

Intrapelvic and Abdominal extensions will be seen as soft tissue masses,with or without calcification ,displaying the gas-containing bowel. Rectal gas should be normally seen directly against the sacrum on the lateral radiography (Dillard et., al 1970) .Fig (5-6-7) .

Fig (5): plain abdominal film, anteroposterior view, shows a soft tissue mass in the lower abdomen and pelvic cavity and displacement of the bowel loops cephalad. The mass has multiple calcifications (red arrows) and a fat component (black arrow). Note urethral catheter (blue arrow).



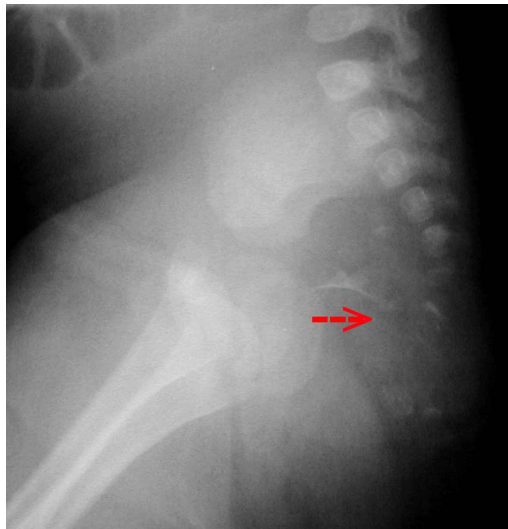


Fig (6) :The lateral film of lower abdomen has multiple calcifications in the mass and a radiolucent area (red arrow), which is the fat component.

Fig (7) :A babygram from the first day of life shows a huge exophytic soft tissue mass arising from the gluteal region.



ULTRASONOGRAPHY

Ultrasonography is of great value in determining whether the tumor is predominately solid or cystic, in identifying the extent of pelvic or abdominal extensions and in identifying secondary obstructive uropathy. Antenatal ultrasonography has allowed the early detection of a broad spectrum structural anomalies contributing greatly to understand of their prenatal natural history (Garmel et., al 1994).

Congenital anomalies remain one of the most common causes of perinatal mortality and morbidity. Serious birth defects affect 3% of all newborns and account for 20% of all deaths in the newborn period. Birth defects account for an even greater percentage of serious morbidity later in infancy and childhood (Ling 1992).

Prenatal diagnosis of structural anomalies provides the opportunity to influence perinatal management favorably by changing the site of delivery for immediate postnatal treatment; altering the mode of delivery to prevent hemorrhage or dystocia; early delivery to prevent ongoing fetal organ damage; or treatment in utero to prevent, reverse, or minimize fetal organ injury as a result of a structural defect (Adzick et., al 1994).

Patients with congenital anomalies are no longer referred at the time of birth, but are often referred at the time of prenatal diagnosis. Increasingly, pediatric surgeons are called on by obstetric colleagues to counsel parents about the implications of a prenatal surgical consultation on perinatal management and mortality had not been investigated previously.

Sonographic Features

Sonographically, a sacrococcygeal teratoma appears as a large mass arising from the sacral end of the fetus (Brace et., al 2000) . These tumors may appear cystic, solid, or complex, and calcifications may also be identified. It can be difficult to classify the type sonographically due to the presence of overlying fetal pelvic bone, which can shadow intrapelvic contents, and magnetic resonance imaging may provide additional information to assist in determining prognosis and operative procedures (Avni et., al 2002) .

Sacrococcygeal teratomas may be highly vascular, which can lead to hemorrhage or vascular steal syndrome, which occurs when blood is shunted away from the placenta to the tumor. (Hall et., al 2002) . Vascular steal syndrome can lead to fetal cardiac failure and can also demonstrate the sonographic findings of placentomegaly, fetal hydrops, and polyhydramnios (Peak et., al 2001) Fig. (8).

Doppler evaluation of sacrococcygeal teratomas, particularly those associated with hydrops, often demonstrates high-velocity flow similar to arteriovenous malformations (Kamata et., al 2001) Fetuses with hydrops are more likely to have more solid, highly

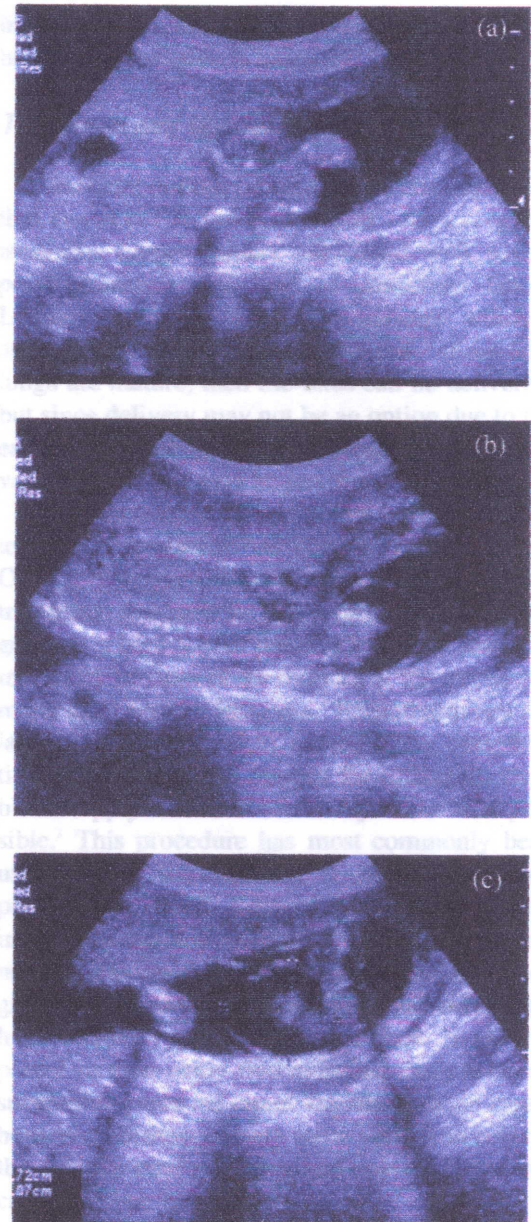


Fig. 8. (a) Coronal, (b) longitudinal, and (c) transverse images demonstrate a complex mass arising from the caudal end of the fetus measuring 3.1 cm in the greatest dimension. The findings are consistent with a sacrococcygeal teratoma.

vascular tumors. Fetuses with predominantly cystic tumors have scanty intratumoral vasculature and a better prognosis (Westerburg et., al 2000) . The presence of a completely solid tumor is associated with a poor prognosis (Avni et., al 2002) .

In addition to polyhydramnios, other sonographic findings associated with sacrococcygeal teratoma include genitourinary anomalies, most commonly hydronephrosis and bladder deformities. (Holterman et., al 1998) .Stress on the fetal heart, which leads to heart failure, may demonstrate cardiomegaly, and if hydrops is evident, findings of anasarca (skin edema), pleural effusions, pericardial effusions, and ascites may be identified.

Amplitude-based color Doppler sonography

Amplitude-based color Doppler sonography (a-CDS), also known as power Doppler sonography, is a new FDA-approved color Doppler technique for the assessment of blood flow.

It is based on evaluation of the Doppler power spectral density, which is the expression of the amount of energy of ultrasonic waves reflected by scatterers, such as moving red blood cells. Display of the power spectrum, therefore, corresponds to the degree of tissue blood flow in a particular region of interest (Dymling et., al 1995) .

There is a case of a fetus with a sacrococcygeal teratoma whose extensive vascularity was clearly demonstrated by a-CDS but not by frequency-based color Doppler sonography (f-CDS). Clinical management was substantially changed by the unexpected information provided by a-CDS.

Anecdotal reports of a-CDS in visualizing blood flow in such diverse conditions and structures as the renal cortex (Rubin et al 1994) .

Torsion of the testicles, inflammation of the extremities (Newman et., al 1994) and superior vena cava have appeared. This new imaging modality also has been studied in simulated in vitro models of regurgitant jets and a low-flow vascular system (Jain et., al 1991).

The role of a-CDS in clinical obstetrics, however, has yet to be defined. Encoding flow in the power mode confers several advantages over f-CDS.

The biggest advantage of a-CDS is its enhanced ability to convey information- containing signals relative to noise, thereby enhancing sensitivity. Because f-CDS displays the mean Doppler frequency shift, which is a function of blood flow velocity, random noise may be depicted as flow in any direction. This can make true flow and noise indistinguishable. Because noise has low power, however, a-CDS demonstrates noise by a uniformly colored background that is easily distinguishable , from true flow. Thus, a-CDS has the ability to image areas of low blood flow and tissue capillary perfusion currently undetectable by frequency-based techniques. Other advantages of a-CDS over f-CDS include a relative lack of aliasing and angle independence.

Disadvantages of a-CDS are few. The image is highly sensitive to tissue motion, making it susceptible to being overwhelmed in high motion tissues such as the hearts . Additionally, the power mode does not provide information regarding direction or velocity of flow.

CT and MRI

On occasion, particularly if malignancy is suspected or if the diagnosis is in doubt, a CT scan will provide useful supplementary information about the extent of the mass within the pelvis, the integrity of the sacrum, the presence of intraspinal extension .etc. CT demonstrates

septae and solid components in otherwise difficult to diagnose lesions.

Either a lateral CT scan or magnetic resonance imaging (MRI) will demonstrate intrapelvic or intraspinal extensions of sacral lesions with great detail. The use of intravenous and rectal contrast with CT will more clearly outline any distortion of urinary tract or large bowel. Fig (9-10-11-12) .

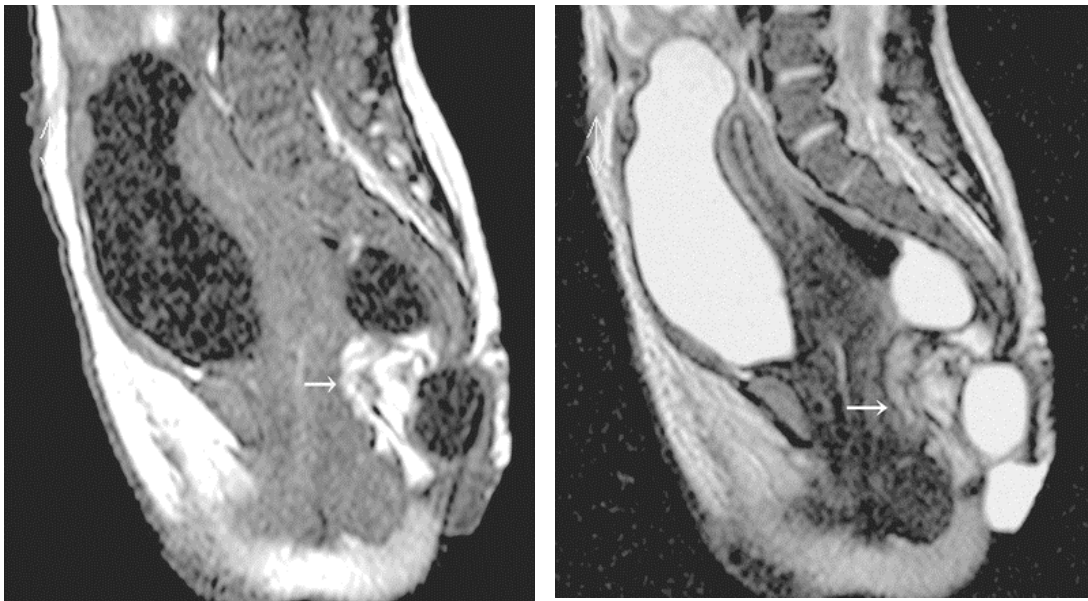
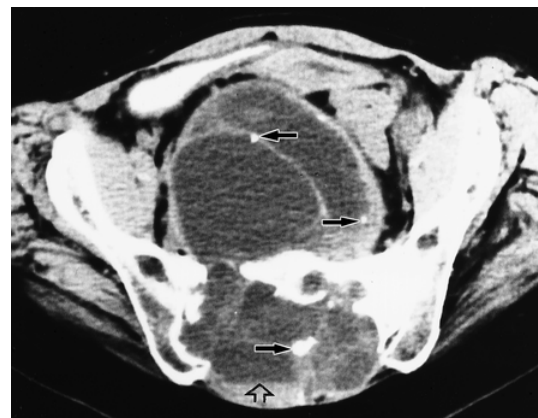


Fig (9) : Immature teratoma of the sacrococcygeal region in a female neonate. The tumor was discovered at birth. (a, b) Sagittal T2-weighted (a) and T1-weighted (b) MR images show a heterogeneous multiloculated mass with a clear margin. There are some cystic components, which include serous fluid. In the anterior part of the tumor, small amounts of fatty tissue are evident (arrow). No calcification or solid component is seen in this case.

Fig (10) : Sacrococcygeal teratoma in a 65-year-old woman. , Frontal radiograph from a myelographic study shows a large soft-tissue mass within the pelvis (straight arrows). The mass causes partial destruction of the sacrum and

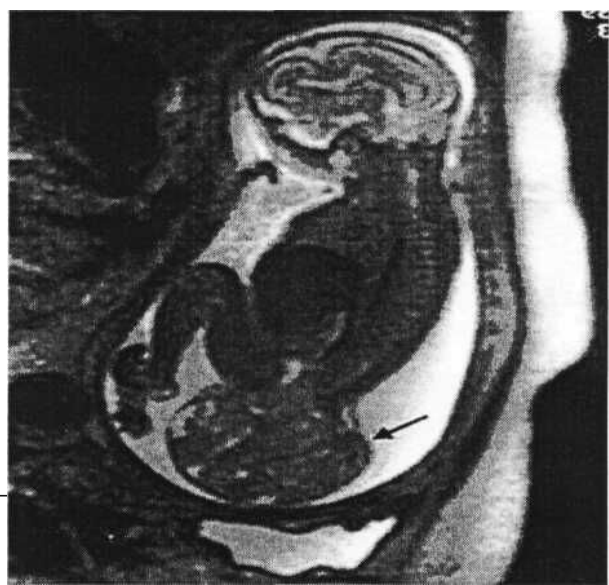


attenuates the column of contrast material (curved arrow) within the lower lumbar spine.

Fig (11): Sacrococcygeal teratoma in a 65-year-old woman. , Nonenhanced axial CT scan shows a large, septated cystic mass with small calcifications (solid arrows). A fluid-fluid level (open arrow) is seen within the dependent portion of one of the cysts.



Fig (12): MRI of sacrococcygeal taratoma: Prenatal MR! of a fetus with a large sacrococcygeal teratoma (arrow) (Mackenzie et al., 2001).



Serum alpha-fetoprotein

Serum alpha-fetoprotein (AFP) is a very useful serum marker in sacrococcygeal teratoma, as an indicator of malignancy. The production of AFP by malignant sacrococcygeal teratomas conforms with the concept of these tumors being of yolk sac origin.

Tsuchida and Hasegawa (1983) collected 61 cases, from various centers in Japan, in which serum AFP levels were had been studied in infants and children with teratomas from various sites. AFP levels were analysed in comparison with the distribution of normal serum AFP values in early infancy. Because these levels remain high for some months postnatally it was doubted whether it would be possible to use AFP as a tumor marker in the first few months of life.

In fact, a clear correlation was made between the serum AFP level and the histological classification of the tumor; levels were above the normal range in 31 of 32 malignant teratomas, three of four 'immature' tumors and in only one of 24 mature tumors.

Billmire and Grosfeld (1986) reported similar findings in 29 patients; elevated levels in 100% of malignant lesions, 50% of immature lesions and 6% of mature benign lesions. Eight patients, all with benign lesions, had serum AFP within the normal range for age.

One great value of the AFP marker lies in its use (or serial postoperative monitoring for malignant recurrence; the early warning which it provides allows for commencement of treatment when the tumor bulk is small, thus increasing the chances of a successful outcome.

SURGERY OF SCT

A-CLASSIC SURGERY

Indications for surgery

Of those children operated upon in the neonatal period, approximately 90% of the lesions are benign. In lesions removed after 6 months of life. 50% or more of the tumors are malignant, with the most common neoplasms being embryonal or yolk sac tumor. This natural history suggests a malignant transformation in a previously benign lesion. With this risk, these tumors should always be excised following discovery. In addition to the apparent malignant degeneration, spontaneous ulceration with exsanguinating hemorrhage may occur because of the tumor's rich vascular supply.

Preoperative

Radiographs of the abdomen and pelvis may reveal calcifications, which are seen in one third of the lesions. Although ultra sonography may demonstrate a pelvic or intra-abdominal component to the tumor, computed tomography scanning may be more helpful in defining the intra - abdominal extent of the disease, which may dictate the surgical approach. Serum α **fetoprotein**, a useful marker for malignant degeneration, is significantly elevated at birth and remains markedly elevated for 90-120 days after birth, decreasing to adult levels only 2 months. None the less, this tumor marker should be assayed and compared to age-appropriate values (Tsuchida et., al 1978) .

Anesthesia

general endotracheal anesthesia is mandatory. High out put cardiac failure secondary to arterio-venous channels in the tumor may

limit the use of inhalation agents, which have known cardiodepressant effects. With the possibility of brisk blood loss during the procedure, reliable venous access is necessary, and blood should be available in the operating room at the time of surgery. An arterial line for pressure monitoring is indicated; central venous monitoring is advantageous but not absolutely necessary. The stomach is emptied with a nasogastric tube, and an indwelling bladder catheter placed. Broad-spectrum antibiotics are given and adjusted for age and weight of the child fig (13).

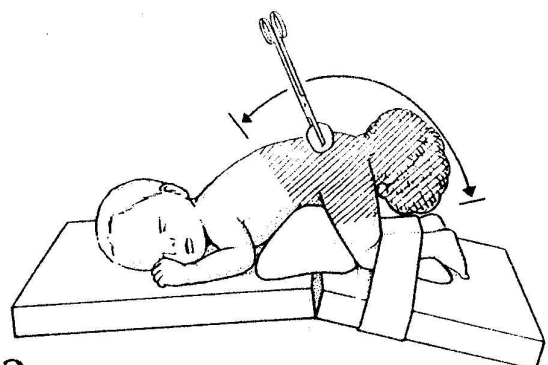


Fig (13) :pre operative huge S C T

Operation

Position of patient

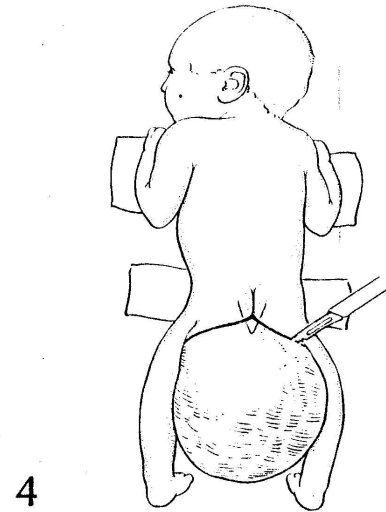
In almost all cases the procedure is performed with the infant in an exaggerated prone jack-knife position.



Rolled towels are used to support the pelvis and shoulders, allowing free movement of the chest and abdominal walls during assisted ventilation. A 1% solution of povidone-iodine (1:10 dilution in saline) is used as an enema to prepare the rectum for digital manipulation during the course of dissection. Other authors prefer to pack the rectum with a petrolatum-impregnated gauze and exclude the anus from the field.

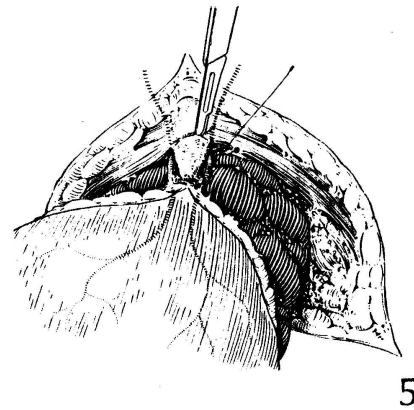
Dorsal exposure

4 A chevron incision is performed with its apex over the sacrum continuing around the dorsolateral surface of the tumor. The tumor capsule is usually well defined and separate from other tissues.



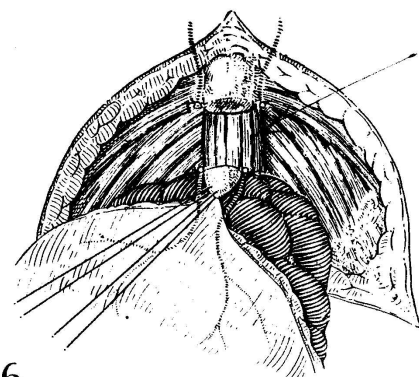
Coccygectomy and control of the middle sacral vessels

5 The sacrum and coccyx are identified and the coccyx is divided at the sacrococcygeal joint. The middle sacral vessels, located immediately beneath this landmark, are controlled in continuity and divided. Any collateral circulation from the lateral sacral vessels must be identified and ligated. Once this early control is established, the dissection becomes relatively bloodless. with an extensive intra-abdominal component, an initial trans-abdominal approach will be required achieve vascular isolation.



Exposure of the proximal rectum

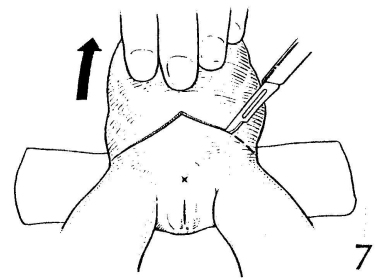
6 The coccyx is always excised with the



teratoma, but the muscles of the pelvic floor are preserved and carefully separated from the tumor during dissection. The coccyx is retracted with the neoplasm and with gentle tension, the teratoma is separated from inferior and medial aspect gluteus maximus muscles. The proximal rectum is identified at the base of the dissection during this portion of the procedure .Fig (14) .

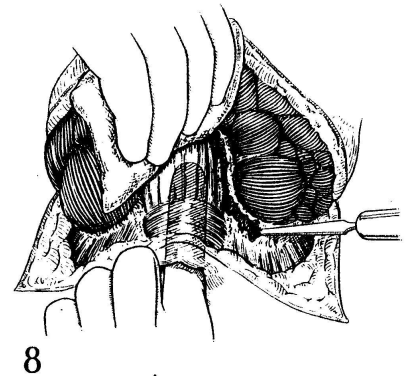
Ventral incision

7 ventral chevron incision is made to allow the assistant to place upward traction on the tumor.



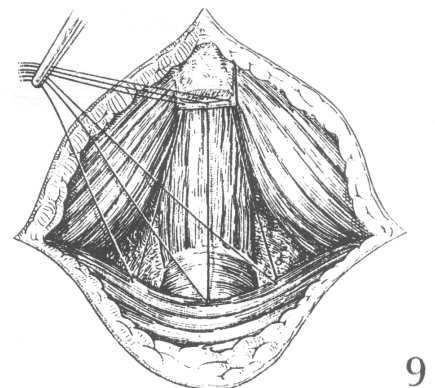
Ventral dissection and exposure of the distal rectum

8 An intrarectal pack or a finger allows the operator to identify the rectum and sphincter complex. Electrocautery is used to separate the fine attachments of the tumor from the anorectal sphincter complex, the levator ani muscles, and the gluteus maximus muscles. With gentle upward tension on the teratoma, the tumor is dissected free and removed.



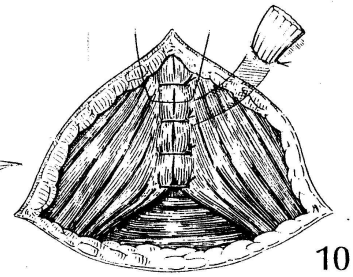
Reconstruction of pelvic floor

9 The posterior and superior portions of the levator muscles are sewn to the presacral fascia using interrupted 4/0 silk sutures. This maneuver allows the anus to assume a near normal configuration and gives the best cosmetic outcome.



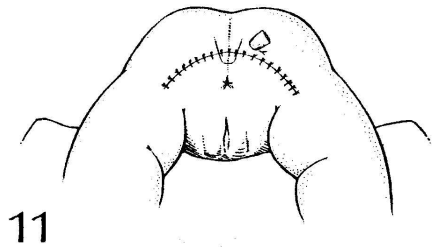
Approximation of gluteus maximus muscles

10 A Penrose drain, which is placed in the I U perirectal space, is brought out through a separate stab incision. The gluteus maximus muscles are then approximated in the mid-line using 3/0 silk or 3/0 polyglactin sutures.



Skin closure

11 The anus returns to a near normal location. Any redundancy to the dorsal skin flap may be trimmed. The incision is closed with interrupted or running 5/0 nylon sutures .Fig (15) .



Abdominal operation

when the tumor extends into the abdomen it must be removed by a combined abdomino-sacral operation (Hendren et., al 1970). The abdomen is opened through a transverse sub-umbilical incision which, if necessary, can be extended upwards and laterally.

The tumor is dissected free from the pelvic viscera and the middle sacral vessels are ligated and divided. The mass must be freed as far down into the pelvis as possible but its attachment to the coccyx must be left intact. The dissection can be difficult if the tumor is impacted in the pelvis and if the tumor can be reduced in volume by aspiration of cyst or cysts this should be done, with precautions against spillage. The abdomen is now closed and the infant positioned, as described previously, for the sacrococcygeal operation. This proceeds as described, with transection of the lower sacrum. The mobilized intrapelvic mass is then delivered, whereupon the lower part of the tumor is dissected off rectum,

gluteus muscles and levator ani, with closure as described.

In one of cases a very large solid tumor of hour-glass shaped could not be coaxed through the pelvic outlet and had to be removed from above and below after transection. According to Ashcraft and Holder, who have a unique experience of presacral teratomas, these can almost always be removed satisfactorily by the sacral approach (Ashcraft and Holder 1974).

Post-operative care

The child is maintained in a prone position to prevent soiling the surgical site with urine or feces for the first postoperative days. The nasogastric tube is removed as bowel activity returns. The perirectal drain is generally removed 24-48 h after the procedure. A pelvic neuropraxia may cause a poorly contracting, neurogenic bladder, which will require intermittent catheterization in the early postoperative period but this problem is usually temporary. Wound infections are infrequently seen despite the considerable rectal manipulation.

If hydronephrosis has been found preoperatively this should be followed up by several ultrasound examinations. The hydronephrosis can be expected to resolve ; failure of this to happen could be an indication for full urological assessment

Postoperative complications

The main postoperative complication is wound infection because of the proximity to the anus of the surgical site and the skin flaps that may be needed (Keslar et., al 1994). Bladder dysfunction may occur (Noseworthy et., al 1981) .

long-term complications

Long-term complications occur frequently with approximately 40% of children experiencing mild functional bowel problems with soiling or constipation, 10 % of infants will have urinary incontinence or neurogenic bladder, often associated with functional bowel impairments (Malone et., al 1990). These problems do not appear to be related to the degree of pelvic tumor involvement, tumor size or the histology of the neoplasm. The tumor may recur if the coccyx is not removed, if malignancy is found at the initial excision and in 5-10 % of children who have excision of apparently benign lesions.

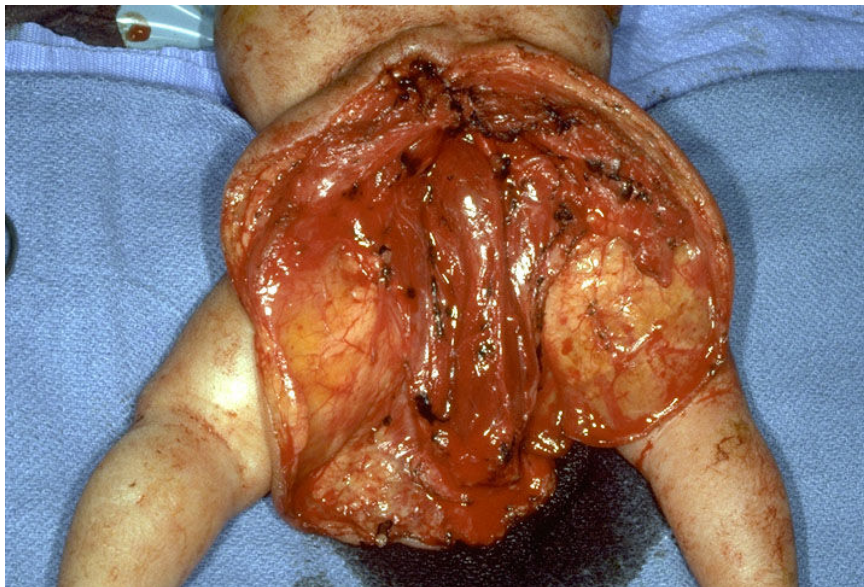


Fig (14) :Operative photograph shows the region after resection of the tumor with the elongated rectum visible in the center.



Fig (15) :Postoperative photograph shows the reconstructed buttocks.

B-RESECTION OF A MASSIVE SACROCOCCYGEAL TERATOMA USING HYPOTHERMIC HYPOPERFUSION

Resection of massive tumors in the neonate is a formidable challenge. Sacrococcygeal teratomas (SCT) are highly vascular, and their resection has been associated with death, owing to hemorrhage, high output cardiac failure, and inability to ventilate secondary to intraoperative fluid shifts. Mechanical circulatory bypass and deep hypothermic circulatory arrest have been used to provide ideal surgical conditions for resection of large tumors (Fraser et., al 1988).

Extracorporeal membrane oxygenation (ECMO) also has been a useful for cardiopulmonary support in neonates and children (Levy et., al 1992). Use of cardiopulmonary bypass (CPB) has been reported for intraoperative support in tumor resections. However, CPB would have necessitated sternotomy or thoracotomy and would have precluded using the prone position, which preferred for such a large tumor. Thus, ECMO via the standard right-neck approach was chosen, incorporating a cardiac anesthetic technique designated to lessen the likelihood of ventricular fibrillation threshold.

C-LAPAROSCOPIC CLIPPING OF THE MEDIAN SACRAL ARTERY IN HUGE SACROCOCCYGEAL TERATOMAS:

Huge sacrococcygeal teratomas in the newborn can cause significant morbidity and even death due to cardiac failure, hemorrhage, or both. Surgical removal is the treatment of choice, but can indicate these events. Ligation of the median sacral artery, which always supplies the tumor, prior to its removal has been advocated, but in the past this procedure required a formal laparotomy. Nowadays, it can be easily accomplished laparoscopically (Kay et., al 1998).

D-INTRA-UTERINE FETAL SURGERY OF SCT

Criteria for fetal intervention

Indications for cyst aspiration and amnioreduction are maternal discomfort, preterm labor, and prevention of tumor rupture at delivery.

Criteria for consideration of open fetal surgery for debulking of SCT required the absence of maternal risk factors for anesthesia or surgery, a singleton pregnancy with normal karyotype analysis, the absence of significant associated anomalies, evidence of impending high-output cardiac failure, GA less than 30 weeks, and favorable anatomy. The development of the maternal mirror syndrome, a preeclamptic condition in which the mother's condition begins to mirror that of the sick fetus, was considered a contraindication to fetal intervention and was treated by immediate delivery (*Hedrick et al., 2004*).

OPEN FETAL SURGERY

General Principles of Open Fetal Surgery techniques

Personnel and Equipment:

The comprehensive care of the fetal surgery patient requires multidisciplinary cooperation. In the operating room, however, several roles have been defined. Responsibility for the patient's anesthesia is usually shared between an obstetric anesthesiologist and pediatric anesthesiologist with a special interest in fetal anesthesia. A high-resolution -ultrasound machine with color and power Doppler is present in the operating room and utilized throughout the procedure.

Experienced sonography is essential for identification of fetal and placental position and to rule out potential hazards such as a velamentous insertion of the umbilical cord. Ultrasound is performed both before the maternal incision and once the maternal abdomen is opened allowing optimal selection of the hysterotomy site. Once the fetal operation is underway ultrasound in combination with pulse oximetry is utilized to monitor fetal heart rate, cardiac function and volume status. A surgical nursing team trained in the specific aspects of fetal surgical procedures and instrumentation is mandatory. The leader of the fetal surgery team is by necessity a pediatric surgeon with specific training in fetal surgical techniques (*Shaaban et al., 2003*).**Fig (20)**

Positioning and Preparing:

The patient is positioned supine on the operating table with a roll under her right side relieving caval compression by the uterus. The patient is then prepped from the mid-thorax to the mid-thigh. The operative field is squared with sterile towels and covered with a fenestrated and pocketed drape (*Shaaban et al., 2003*).

Incision and Exposure:

The uterus is exposed through a low transverse abdominal incision. If the placenta is situated posteriorly, subcutaneous flaps are created and a midline incision is made in the fascia extending from the umbilicus to the symphysis pubis. If the placenta is anterior then the fascia and rectus musculature are divided transversely. This incision permits anterior rotation of the uterus, which facilitates a posterior hysterotomy. A large abdominal ring retractor is then positioned for abdominal wall retraction (*Shaaban et al., 2003*)

.Fig

(16)

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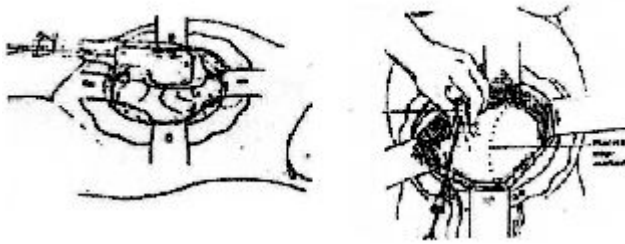


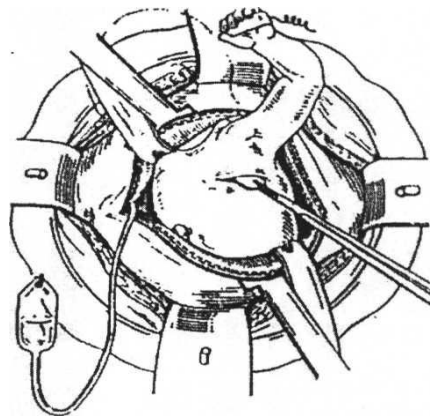
Fig. (16) Incision and exposure: The uterus is exposed through a low transverse abdominal incision. Ultrasoundography is used to localize the placenta, inject the fetus with narcotics & muscle relaxant and aspirate amniotic fluid (*Hedrick et al., 1999*)

Opening the Gravid Uterus:

Following uterine exposure and before hysterotomy, adequate uterine relaxation is assessed by palpation. The uterus must be completely relaxed before any operative manipulation. The orientation of the fetus and position of the placenta are then determined by transuterine ultrasound. The margin of the placenta is carefully mapped with the electrocautery on the surface of the uterus under ultrasound guidance. The position of the hysterotomy is critical to provide adequate exposure of the part of the fetus being operated on while at the same time avoiding the placenta and uterine vasculature. The lower segment of the uterus (*the usual position for the hysterotomy with a standard cesarean section*) is not used to avoid an increased risk of amniotic fluid leak, chorioamnionitis and preterm labor. Following determination of the optimal position of the hysterotomy, two opposing traction sutures are placed under ultrasound guidance to include the full thickness of the uterine wall and fetal membranes. The myometrium is incised over approximately 2 cm between the sutures using the electrocautery until the membranes can be visualized. A modified uterine stapler that was designed specifically for open fetal surgery is used for the hysterotomy. A sharp trocar placed over the anvil of the stapler allows easy passage

through the membranes at the site of the myometrial incision. The stapler is positioned and fired once in each direction. By design, the stapler compresses the myometrium and controls the membranes allowing nearly bloodless entry into the uterus while simultaneously maintaining membranes integrity for closure. A rubber catheter connected to a rapid infuser is then inserted into the amniotic space to replace egress of amniotic fluid with warmed Ringer's lactate. This maneuver maintains fetal temperature and prevents amniotic space volume loss during the procedure, which reduces the frequency of uterine.

contraction. Additionally, by maintaining the buoyancy of the fetus in the amniotic fluid, it avoids umbilical cord compression (*Shaaban et al., 2003*).Fig (17-18).



Fig(17) Opening the gravid uterus: The uterus is opened with staples that provide homeostasis and seal the membranes. Warm saline is continuously infused around the fetus (*Hedrick et al., 1999*).

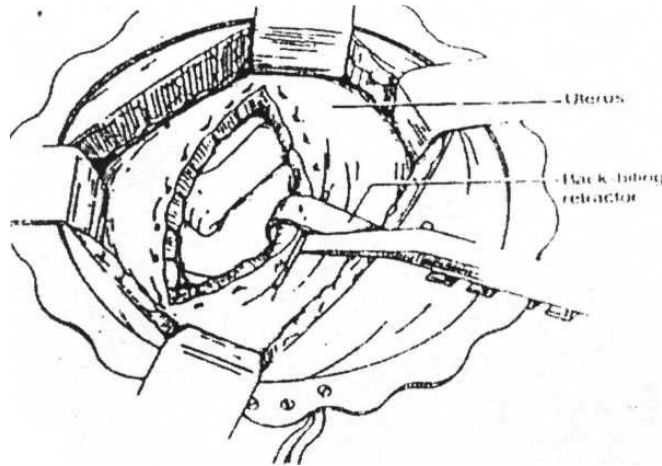


Fig (18) Opening the gravid uterus: Back-Biting clamps facilitates hysterotomy. Miniaturized pulse oximeter records pulse rate and oxygen saturation intraoperatively (Thomas, 1995).

SCT debulking procedure:

By the previous described techniques for opening the uterus, the fetal SCT is exposed, and a Hegar dilator is placed in the rectum. The fetal skin is incised circumferentially around the base of the tumor, and a tourniquet is applied to constrict blood flow. The tumor is debulked externally usually with a 90-mm thick tissue stapler. The objective of fetal SCT resection is to occlude the tumor vascular supply and remove the low-resistance tumor vascular bed from the fetal circulation. No attempt is made to dissect the intrapelvic component of the tumor or to remove the coccyx. Fetal resuscitation is performed if needed with intravenous administration of crystalloid, blood, and medications. The fetal sacral wound is closed, amniotic fluid is replaced with warm lactated Ringer's solution, and the uterine and laparotomy wounds are closed (Chisholm et al., 1999).

Closure of the Gravid Uterus:

One of the unique requirements of fetal surgery is that not only must the surgeon operate on the fetus, but the surgeon must also return the fetus to the amniotic space in such a way as to optimize the

remainder of gestation. Absolute requirements for the closure are that it should have adequate strength to prevent rupture, that the membranes are re-approximated and watertight, and that the closure not contributes to preterm labor or to future infertility of the mother. Complications such as an amniotic fluid leak or uterine rupture from a weak closure may severely compromise the outcome of the pregnancy and endanger maternal safety. Now, the routine technique is closing the uterus in two layers, leaving the absorbable uterine staples in place. The uterine staples control the membranes and maintain homeostasis during closure. A layer of full thickness 0 monofilament absorbable (PDS) retention is placed through the myometrium and membranes. Before this layer has been completed, the rapid infuser is utilized to restore the amniotic volume as determined by ultrasound visualization. Antibiotics are administered through the catheter as it is withdrawn, and the suture line is tied. The retention sutures are then tied over the myometrial closure, reinforcing the closure and relieving the tension from the wound. An omental pedicle is secured over the hysterotomy to seal any small leaks from the full-thickness sutures. With this closure, there is a very low rate of clinically significant amniotic fluid leaks, and on delivery, the hysterotomy appears to have good integrity. The rate of subsequent pregnancy following fetal surgery has been excellent in couples desiring more children, confirmed by experimental work in the monkey (Shaaban *et al*, 2003). Fig (19).

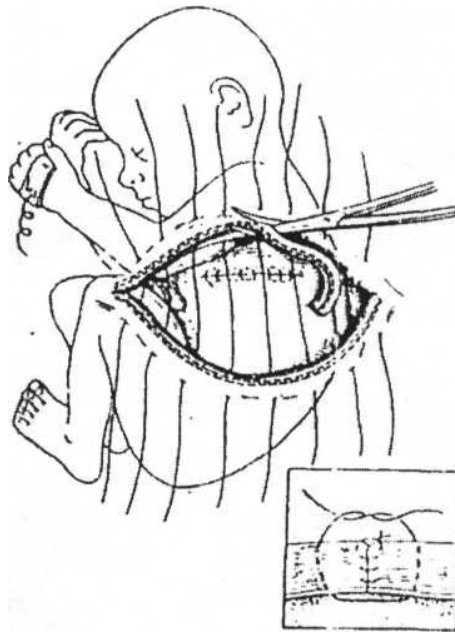


Fig. (19) Closure of the gravid uterus: After repair, the uterus incision is closed with absorbable sutures and fibrin glue. Amniotic fluid is restored with warm lactated Ringer's solution (**Thomas, 1995**).

Tocolysis and Postoperative care:

Preterm labor is the single biggest concern during the operation and in the postoperative period. Following an approach that has evolved somewhat empirically, It is rare to have uncontrolled intraoperative or early postoperative uterine contraction. Beginning the tocolytic regimen with a 50-mg indomethacin suppository 4 hours before surgery. The patient remains on indomethacin 50 mg every 6 hours for 48 hours postoperatively, and the fetal status is monitored closely by daily fetal echocardiography. There are another two measures that have had a major impact on early uterine irritability. First, the preoperation placement and maintenance of an epidural catheter for 3 days after surgery appears to prevent maternal pain and secondary stress response. Second, the use of deep inhalation anesthesia for uterine relaxation during the operation has prevented the initiation of uterine contraction. Assessing uterine relaxation before making the uterine incision is critical and an increase in the depth of anesthesia may be required to obtain complete relaxation. Bolus doses of terbutaline and an infusion of nitroglycerin are available in the operating room for irritability not controlled by the gaseous anesthesia, but these are rarely required. During closure of the hysterotomy, the patient is given a 6-g bolus of magnesium sulfate followed by a continuous infusion at 2-4 g/h. The patient is allowed to emerge from anesthesia while being observed closely for uterine activity. She is transferred rapidly to a maternal intensive care unit for hemodynamic and tocodynamometry monitoring. Magnesium sulfate infusion is maintained for 48-72 hours, with magnesium levels monitored frequently and observation for clinical signs of magnesium

toxicity. If uterine irritability arises, terbutaline doses are administered subcutaneously as the mother's heart rate permits. On the second to third postoperative day, the indomethacin and magnesium can usually be weaned and the patient is then converted to a subcutaneous terbutaline pump. The patient is maintained on the subcutaneous pump at bed rest until the time of delivery. Fluid management in the fetal surgery patient is critical. The most serious postoperative complication seen in fetal surgery mother thus far has been noncardiogenic pulmonary edema, which is precipitated by the physiology of pregnancy and the use of magnesium sulfate tocolysis. Minimizing intraoperative crystalloid administration and maintain judicious administration of fluids in the postoperative period is recommended. In addition, daily echocardiography assessment of the fetus allows direct monitoring of fetal cardiac function and the status of the ductus venosus during indomethacin therapy. Daily ultrasound examinations while the patient is hospitalized allow assessment of the amniotic fluid index, which reflects fetal urine output (*or amniotic fluid leak*). Another important observation is fetal movement, which is an indirect assessment of fetal well-being. After discharge from the hospital, the mother is required to stay at bed rest in the immediate vicinity of the hospital. Ultrasound is performed at least twice weekly and the uterus is monitored for irritability once daily (*Shaaban et al, 2003*).

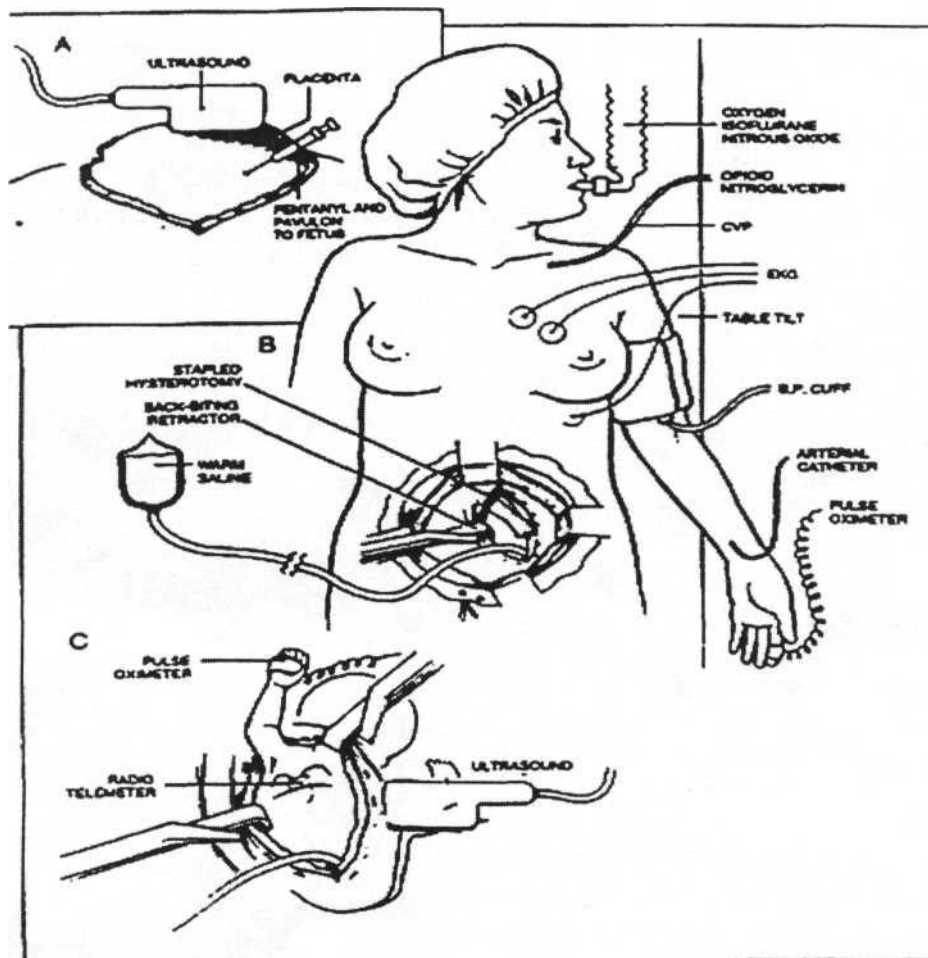


Fig. (20) Fetal surgical techniques: (A) Ultrasound is used to map the borders of the placenta before hysterotomy. The fetus may be given intramuscular fentanyl and pavulon at this time for additional fetal anesthesia. (B) Maternal monitoring during fetal surgery consists of ECG, arterial line, blood pressure cuff, pulse oximeter, and in some cases, central venous line. The table is tilted to avoid aortocaval compression by the gravid uterus. The hysterotomy is performed by a haemostatic stapling device and warm Ringer's lactate is infused via a level I warming device to maintain amniotic fluid volume and temperature. (C) Fetal monitoring consists of pulse **oximetry** and continuous fetal echocardiography during the procedure. Implantable radiotelemelry devices may also be used (**Mackenzie et al, 2001**).

complications and death. Neonatal death may result from the maternal obstetric complications of tumor rupture, preterm labor, or dystocia. Tumor rupture may be caused by uncontrolled labor or delivery complications. Impending preterm labor from polyhydramnios or uterine distension from tumor mass may require treatment by amnioreduction or cyst aspiration. Dystocia can be prevented by planned cesarean section delivery. The fetus also is at risk for high-output cardiac failure, placentomegaly, and hydrops with subsequent fetal demise secondary to the metabolic demands and vascular steal of a rapidly growing solid tumor. In a select subset of fetuses with SCT, this tumor physiology may be reversed by surgical debulking of the tumor in utero (*Flake, 1993*).

Delivery and postnatal management:

Delivery by cesarean section was performed for indications of impending preterm labor. Postnatal management in the neonatal intensive care unit included the use of mechanical ventilation when necessary. Definitive resection of the SCT and coccyx was performed once medical stability was achieved (*Hedrick et al., 2004*).

Thermal ablation of SCT:

Radio frequency thermal ablation and laser therapy to occlude the arteries feeding an SCT are alternatives of open fetal surgery. These techniques can be performed percutaneously with ultrasonographic guidance, significantly decreasing the incidence of preterm labor and maternal morbidity as compared with open fetal surgery (*Paek et al., 2001*).

E-INTRAUTERINE ENDOSCOPIC LASER SURGERY FOR FETAL (SCT)

An attempt to interrupt the blood supply of the tumor. The procedure, which has been performed before to coagulate the communicating placental blood vessels in twin-twin transfusion syndrome and acardiac twins (Ville et., al 1995) . With color-doppler imaging, the main supplying blood vessel of the tumor could be seen 3mm under the skin surface of the mediosacral region.

Under sonographic control, a 1.9mm diameter rigid fetoscope with a field of vision of 60 degree is introduced precutaneously into the amniotic cavity through a sheath with 9.8 charrier under local anaesthesia and maternal analgesic . A 0.4 mm Nd-YAG laser fibre is passed down the side-arm of the cannula. For fetal anlgesia,0.1mg morphine is given intramuscularly under ultrasonic guidance.

The prenatal diagnosis of sacrococcygeal teratoma is associated with high fetal mortality caused by high-output fetal cardiac failure due to a vascular steal by arteriovenous shunts in the tumor and hemorrhage causing anemia. Open fetal surgery at 24 weeks for SCT in one case resulted in reversion of fetal hydrops after excision of the tumor but resulted in premature labour and delivery of a nonviable infant. Intrauterine endoscopic laser surgery for fetal sacrococcygeal teratoma may have prevented heart failure and hydrops in this case.

The introduction of a second trocar to insert an additional instrument to grasp the external tumor may be helpful to interrupt blood flow in the main arterial vessel. Drugs that reduce the incidence of hypothermias, such as thiopental and fentanyl, were used. With ECMO circuit flows, we were able to effectively control blood pressure, patient

volume, and temperature.

Surgical management of a huge SCT in a small infant requires a creative approach. Close planning and teamwork between personnel from surgery, cardiac surgery, anesthesia, nursing and the extracorporeal perfusion team were essential to the successful outcome in this complex case.

F-PRENATAL PERCUTANEOUS NEEDLE DRAINAGE OF CYSTIC SACROCOCCYGEAL TERATOMAS:

Prenatal ultrasound (us) permits in utero diagnosis of sacrococcygeal teratoma (SCT), follow-up of tumor size, and the early identification of complication, allowing for a more timely and appropriate delivery. The recommended management of large SCTs is delivery by cesarean section (CS) to prevent dystocia, tumor rupture, hemorrhage, and death. However, even delivery by CS can be difficult, necessitating a large hysterotomy that adds to maternal morbidity.

The cystic SCT is percutaneously drained just before induction of labor at full term, again allowing for an uncomplicated vaginal delivery. Prenatal percutaneous needle drainage of cystic SCTs offers an alternative to CS that results in decreased risks for both mother and fetus (Goel et., al 1999) .

G-Management at delivery

The management of sacrococcygeal teratomas depends on fetal gestational age and wellbeing, the presence of associated anomalies, and tumor vascularity assessed by colour flow Doppler (Kum et., al 1993). Highly vascular tumors should be delivered by caesarean section to avoid risk of haemorrhage during the second stage of labour. Robertson et al reported devascularisation of a sacrococcygeal teratoma to decrease the chance of spontaneous haemorrhage in a preterm neonate (Robertson et., al 1995) .

Antenatal ultrasound had confirmed the highly vascular nature of tumor with several large feeding vessels arising from the internal iliac arteries. Both internal iliac arteries and the small middle sacral artery were ligated, after stabilisation of respiratory status (Robertson et ., al 1995).

Delivery should be conducted in a tertiary hospital. The size of a sacrococcygeal teratoma determines the mode of delivery. Non-vascular tumors and those less than 10 cm in diameter may be delivered vaginally (Kum et., al 1993). However Gross et., al recommended caesarean delivery in all fetuses with sacrococcygeal teratomas of more than 5 cm diameter to minimise the risk of rupture and haemorrhage (Gross et.,al 1987) .

Tumor size has been more than 10 cm in almost all reported cases with difficult deliveries. Teratomas should be well protected after delivery because erosion of the surface may precipitate bleeding before surgical excision is undertaken (Teilelbaum et., al 1994). Blood loss in large and even benign tumors has been reported to be substantial sometimes equalling the patient's blood volume. Most reviews report mortality ranging from around 5% to 9% following exsanguinating haemorrhage (Dewan et.,

al 1987).

Grosfeld et al reported disseminated intravascular coagulation in a neonate who suffered tumor rupture and haemorrhage during delivery (Grosfeld et., al 1976). The aetiology of such clotting abnormalities is probably complex and multi-factorial (Murphy et., al 1992). Extensive disruption of large defective tumor endothelium during labour and delivery could precipitate fulminant disseminated intravascular coagulation. Trauma to the sacrococcygeal teratoma during delivery may cause entry of tissue thromboplastin into the blood stream resulting in activation of the coagulation cascade. Good vascular access and adequate supply of blood products is thus necessary before surgery.

During surgery precautions must be taken to prevent hypothermia, which is easily precipitated because of the large surface area and the vascularity of the tumor (Teitelbaum et., al 1994). The treatment of choice for sacrococcygeal teratoma is early surgical resection with complete excision of the coccyx because microscopic nests of neoplastic cells are commonly found in or immediately adjacent to the coccyx (Brinker et., al 1989) .

A recurrence rate of 37% was reported when the coccyx was not removed completely (Crussi et., al 1978) . Patients with malignant sacrococcygeal teratomas are managed after surgery with irradiation if residual disease is present and always with combination chemotherapy (Arceci et., al 1994) .

Follow up and recurrence

The recurrence rate of sacrococcygeal teratomas varies between 7.5% and 22%. In contrast to previous reports, (Dewan et., al 1987). Bilik et al found a higher recurrence rate for primary sacrococcygeal teratomas with larger mean diameters (11.1 (3.2) cm with recurrence v 7.9 (4.4) cm with no recurrence (mean (SD)); $p = 0.07$) (Bilik et., al 1993). They concluded that despite multiple histological sections in large primary tumors reported as benign, these large tumors may well harbour undetectable small foci of malignant endodermal sinus cells.

Serum alpha fetoprotein in the first month of life and immunohistochemical markers are not reported to be of prognostic significance (Lahdenne et., al 1990) . However, after total resection of primary sacrococcygeal teratoma together with the coccyx, a raised serum alpha fetoprotein has been found to be a reliable marker of recurrence of poorly differentiated yolk sac tumors. Bilik et al reported markedly raised serum alpha fetoprotein in malignant recurrent compared with benign sacrococcygeal teratomas (Bilik et., al 1993) .

As none of the variables except tumor size was found to be a reliable predictor of recurrence, these investigators concluded that meticulous routine physical examination is essential every three to six months for at least the first three postoperative years to detect recurrence.

They also emphasized the importance of regular serum alpha fetoprotein measurements, prompt radiographic investigations to detect possible recurrences (for example where there is raised alpha fetoprotein but clinically undetectable tumor), and the need to regard every recurrence as potentially malignant. The potential for late occurrence of malignancy in mature sacrococcygeal teratoma is well documented (Lack

et., al 1993) .

Lack et al reported infiltration of virtually the entire coccyx with an adenocarcinoma 40 years after the resection at two months of age of a congenital mature teratoma . Lahdenne et al followed up 45 patients (aged 4-43 years) (mean 21.5 years) for detection of late recurrences (Lahdenne et., al 1993). All had been operated on in infancy for benign sacrococcygeal teratomas. Three recurrences (two benign and one malignant) were diagnosed 21 to 43 years after the initial diagnosis and operative treatment; coccygectomy had not been performed as a primary procedure in patients with malignant recurrence. Rescorla et al reported recurrent disease in nine of 80 patients (11%) with mature teratomas, at between 6 and 34 months after resection (Rescorla et., al 1998).

Three had metastatic disease. Two were long term survivors after surgery alone. Six were alive at a mean follow up time of 114 months after chemotherapy (5) and pelvic irradiation (1). One patient with metastatic disease was lost to follow up. This series also included cases of immature teratoma and endodermal sinus tumor (EST).

Of 24 children with immature teratoma followed up for an average of 39 months, one (4.2%) had a rising alpha fetoprotein level 6 months after the initial procedure and required resection. The child was free of disease 33 months after the second procedure. Of the 13 neonates and infants with EST, nine underwent early surgery with complete resection. Seven were long term survivors. Two died from non-disease-related causes. One child whose lesion was observed after birth presented with metastatic disease at 10 months of age and underwent incomplete resection at that time. She died despite adjuvant treatment. Three other patients presenting between seven and 30 months of age without evidence of metastatic disease underwent complete resection and were long term survivors (Rescola et.,

al 1998) .

Schropp et al reported their experience with sacrococcygeal teratomas in children over four decades (1950 to 1990) (Schropp et., al 1992) . Of 73 teratomas, 57 (78%) were benign and 16 (22%) malignant. There were five recurrences in children with benign disease, only one of which did not have an initial coccygectomy.

The average age at presentation of benign sacrococcygeal teratomas was 20 days v 468 days in those with malignant disease. Seven of the 16 children with malignant sacrococcygeal teratomas were long term survivors. The average survival was 9.3 months in the nine children who died (range 1 to 28 months). Only two of 10 cases (diagnosed between 1976 and 1991) undergoing chemotherapy and radiotherapy for malignant disease died with disease (80% survival).

Three deaths occurred in those with benign sacrococcygeal teratomasa (95% survival). One neonate died in the immediate postoperative period because of complications (rupture of hepatic subcapsular haematoma and disseminated intravascular coagulation with sepsis) (Schropp et., al 1992). Maturation from malignant to benign sacrococcygeal teratoma after chemotherapy (pseudoretroconversion) has been reported (Cranston et., al 1994) .

Sequelae of sacrococcygeal teratoma

The type of the teratoma and the surgical approach both contribute to functional sequelae. Tumors with a large presacral component may present with lower extremity weakness or paralysis, constipation, abdominal distension, and urinary tract symptoms secondary to bladder outlet obstruction (Leung et al., 1985). Isolated cases of lower extremity weakness or paralysis and bladder dysfunction have been described postoperatively, particularly in association with malignant lesions. Many of the previously reported large series did not report long term faecal and urinary incontinence (Tapper et al., 1983).

Engelskirchen et al reported electromanometrically detected rectal and bladder dysfunction in 40% of children following excision of sacrococcygeal teratoma, although none had overt incontinence (Engelskirchen et al., 1987).

Malone et al reported on 27 patients followed up for a mean period of five years (range 2-12). Eleven (41%) had some form of functional impairment. Faecal and urinary incontinence were present in nine. Two had lower extremity weakness because of sciatic nerve palsy (Malone et al., 1990). Tumors with large intrapelvic extensions requiring an abdomino-peritoneal approach for resection were associated with a higher incidence (67%) of functional sequelae. It was concluded that it was impossible to determine retrospectively whether dysfunction was caused by the tumor itself or by the surgery.

Rintala et al evaluated quality of life and faecal continence in 26 adult patients (mean age 30 years) who had undergone surgery for benign sacrococcygeal teratoma in infancy (Rintala et al., 1990). Good

faecal continence was reported by 88% of these patients. However, only 27% had completely normal bowel habits. Some faecal soiling was present in 27%. No correlation between the severity of anorectal malfunction and the degree of intrapelvic extension of the tumor was found. Other health problems, including urinary incontinence, were reported by 13 patients (50%). All control subjects (26 healthy patients of similar age and sex distribution) had good faecal continence). 77% had completely normal bowel habits.

Hypergonadotropic hypogonadism and sperm abnormalities have been reported in men born with benign sacrococcygeal teratomas. Such patients may have Leydig cell dysfunction, abnormal spermatogenesis, or both. The association of these with sacrococcygeal teratomas may reflect a congenital germ cell defect (Lahdenne et., al 1991) .

Chemotherapy

Cisplatin, bleomycin, vinblastin and/or VP-16 (etopo side) has had reported success as first-line therapy in the treatment of extragonadal germ cell tumors. This regimen may shrink the tumor, which may then be amenable to secondary resection. However, 4-year survival with extragonadal malignant teratoma is only 38% and the ideal chemotherapeutic regimens are:

Table (4) :Various Chemotherapy Regimens for Germ Cell Tumors

	<12 months of age (every 3 weeks)	>12 months of age (every 3 weeks)
Regimen 1 (PEB)		
Cisplatin(P)	1.1 mg/kg/IV on days 1,2, and 3	33.3 mg/m ² /IV on days 1,2, and 3
Etoposide (E)	55 mg/kg/IV on days 1,2, and 3	167 mg/m ² /IV over days 1,2, and 3
Bleomycin (B)	0.5 units/kg/IV on day 1 OR	15 units/mVIV on day 1
Regimen 2 (HDP/EB)		
Cisplatin	1.3 mg/kg/IV on days 1-5	40 mg/mVIV on days 1-5
Etoposide	3 mg/kg/IV on days 1-5	100 mg/m ² /IV on days 1-5 15
Bleomycin	0.5 units/kg on day 1	15 units/m ² on day 1

Disease is evaluated in week 12. If complete remission then discontinue chemotherapy; If partial remission then surgery (week 12) followed by two more cycles of chemotherapy as above (weeks 13 and 16).

Table (5) :Chemotherapy Regimens for Malignant Germ Cell Tumors

Site	Histology	Therapy
Malignant	Stages I-IV	PEB or HDP/EB every 3 weeks, x3 cycles
Extragonadal		followed by surgery
germ cell and		If CR, discontinue therapy; if PR, 3 more cycles
tumor		repeat surgery
Immature		Surgery alone
teratoma"		

Abbreviations: CR, complete remission; PR, partial remission. 'If AFP is increased, chemotherapy as per Table ().

Radiotherapy

Radiotherapy can produce responses in immature teratoma, but the dose required is in the range of 4500-5000 cGy, because most patients are under 1 year old, such high dose radiation therapy can have severe long term sequelae. Radiotherapy is therefore only recommended for diseases that resist after chemotherapy and attempted re-excision.

Conclusion

In the last two decades, there are a number of technological advances in the diagnosis of sacrococcygeal teratoma and because of overall improvement in treatment of pediatric patients, including better ventilators, parenteral nutrition, indwelling catheters, advanced antibiotics and adjuvant chemotherapy, the mortality and morbidity rates have decreased significantly. The mortality rate is minimal for cases diagnosed in the newborn nursery. But, the mortality rate exceeds 50% for cases diagnosed in the second trimester, owing to prematurity and tumour induced hyperdynamic state.

The course of sacrococcygeal teratoma diagnosed on routine sonograms is associated with a higher-than-expected incidence of prenatal and perinatal complications. Close antenatal follow up for new onset polyhydramnios and the presence of a completely solid tumour will help to optimize patient counselling and treatment. The recommended management of large SCT is delivery by cesarean section to prevent dystocia, tumor rupture, hemorrhage and death.

Prenatal percutaneous needle drainage of large cystic SCT allowed for uncomplicated vaginal delivery.

CT scan and MRI are both reliable and helpful diagnostic modalities. Its real value lies in assessing of the recurrent and the presence or absence of distant metastasis.

The primary surgical treatment may play a role in the pathogenesis of impaired anorectal and urinary functions. Therefore, during dissection of

the tumour, meticulous surgical technique should be used in order to preserve the anorectal sphincter complex and pelvic nerves.

Scrum ct-fetoprotein (AFP) level is very valuable for monitoring of tumour recurrence and the effect of chemotherapy as well .

Regular follow up by rectal examination, serial **monitoring of serum** AFP levels, with subsequent radiological confirmation allows early detection of recurrence.

Promising results obtained after prompt treatment of malignant recurrence by surgery and adjuvant chemotherapy.

Summary

Teratomas are composed of tissues that are strange to the anatomic site of appearance and disposed in a disorganized fashion. They derive from embryonic pluripotent cells and may have various degrees of maturation, according to which they are classified as mature, immature, and malignant (malignant tissue of germ cell origin) .

Teratomas with malignant transformation contain malignant cells derived from mature tissues. Pluripotent cells are normally present in the gonads, and may also be found in abnormal sequestered midline embryonic rests. Accordingly, teratomas are found with decreasing frequency in the ovaries and testis, mediastinum, retroperitoneal space, sacrococcygeal zone, pineal and other intracranial locations .

Sacrococcygeal teratomas are thought to originate from multipotential cells in Henson's node, which migrates caudally to rest in the coccyx . They may grow postero-inferiorly into the gluteal area and/or antero-superiorly into the abdominopelvic cavity. There is a tendency among the paediatric population toward malignant transformation of sacrococcygeal teratomas with increasing age. However-, in adult patients, benign tumours predominate .

Exclusively presacral tumours present later than those with an external component, and have a higher prevalence of malignant transformation. They can present with chronic fistula, low back pain or obstructive symptoms of the gastrointestinal or genitourinary tracts. In the reported case the sacrococcygeal teratoma might have been the cause of the dystocic forceps deliveries. Conventional studies performed with contrast material may demonstrate extrinsic narrowing with anterior displacement of the rectum, lateral displacement of the rectosigmoid

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colon and compression of the urinary bladder against the anterior abdominal wall, caused by a space occupying presacral lesion. CT and MRI are the most important investigations for characterization of the mass, evaluation of its intrapelvic extension and relationship to other structures. Most commonly, teratomas appear as a complex mass with roughly equal amounts of solid heterogeneous and cystic areas with or without septations.

They also frequently present as thick walled cystic masses, sometimes multiloculated, that may contain fat, calcified elements and/or small solid nodules predominantly solid masses are uncommon

Complex, predominantly solid tumours are more likely to be malignant and significant areas of necrosis within the tumour, or poor definition of adjacent soft-tissue planes, are signs suggestive of malignancy.

Invasion of adjacent structures, rather than simple displacement, sacral destruction and secondary findings such as locoregional lymph node and distant metastases are clearly indicative of malignancy . Nevertheless, imaging features alone do not allow definite differentiation between benign teratomas and those with malignant transformation. In the absence of aspects suggestive of malignancy, benignity must not be assumed.

CT is the most sensitive method of demonstrating calcification/ossification, which may be visible in over 50% of malignant tumours , and the integrity of adjacent cortical bone. Fat-fluid or fluid-debris levels may appear with complex cyst contents. MRI better depicts cystic elements, the contents of which might be inferred from signal intensity patterns on different sequences. Fat components can be identified by either CT or MRI, CT and MRI are complementary in the evaluation of sacrococcygeal column anomalies such as spinal dysraphism, sacral agenesis, pressure erosion and remodelling that can be associated with sacrococcygeal teratomas.

The treatment for all sacrococcygeal teratomas consists of early and complete surgical excision with coccygectomy. This bone may contain a nidus of pluripotent cells that increase recurrence rates to 37% when not excised . Surgical approach depends on size and topographic location of the tumour . Solid teratomas may be very vascular, causing important intraoperative haemorrhage . Pre-operative angiography may be considered for previous blood supply evaluation and embolisation in larger tumours . If complete resection is accomplished, benign teratomas have a good prognosis and long-term survival is possible with malignant tumours. Because malignant transformation is rare there has been no standard recommendation for the use of chemotherapy or radiation and the best treatment plan seems to be referral to an oncology centre, where individualized multimodality therapy can be achieved .

References

- (1) Adzick NS, Harrison MR: The unborn surgical patient. *Curiprob* Surg31:1-63,1994
- (2) Ahmed HA, Pollock DJ: Malignant sacrococcygeal teratoma in the adult. *Histopathology* 9:359-363,1985.
- (3) Altaian, R.P., Randolph J.G and Lilly, J.R. Sacrococcygeal teratoma; American Academy of Pediatrics Surgical Section Survey-1973. *J. Pediatr. Surg.*, 14:352-355,1974.
- (4) Alter DN, Reed KL, Marx GR, et al: Prenatal diagnosis of congestive heart failure in a fetus with a sacrococcygeal teratoma. *Obstet. Gynecol* 71:978-981,1988.
- (5) Altman RP, Randolph JG, Lilly JR. Sacrococcygeal teratoma. The American Academy of Pediatrics Surgical Section Survey—1973. *J. Pediatr. Surg.* 1974;9:389-398
- (6) Arceci RJ, Weinstein HJ. Neoplasia. In: Avery GB, Fletcher MA, MacDonald MG, eds. *Neonatology, pathophysiology and management of the newborn*. Philadelphia: J B Lippincott, 1994:1219-20.
- (7) Ashcraft, K.W and Holder, T.M: hereditary presacral teratoma. *J.Pediat. surg.*, 9:691-697,1974.
- (8) Avni FE, Gnidaud L» Robert Y, Segers V, Ziereisen F, Delaet M-H, et al MR imaging of fetal sacrococcygeal teratoma: diagnosis and assessment. *AJR* 2002; 178:179-183.
- (9) Azizkhan RG, Haase CM, Applebaum II, Dillon PW, Coran AG et al. Diagnosis, management, and outcome of cervicofacial teratomas in neonates: A Childrens Cancer Group Study. *J. Pediatr*

-
- Surg 1995. 30: 312-316.
- (10) Berry CL, Keelnig .1. Hilton C: Teratoma in infancy and childhood. A review of 91 cases. J Palhol 98:241-252. 1969.
- (11) Bilik R, Shandling B, Pope M, et al. Malignant benign neo natal sacrococcygeal teratoma. J Pediatr Surg 1 993;28:11 58 60.
- (12) Billmire, D.F, and Grosfeld, J.L. Teratomos in childhood: analysis of 142 cases. J.Pediat. Surg. 21:548-551,1986.
- (13) Bond SJ, Harrison MR, Schmidt KG. Death due to high-output cardiac failure in fetal sacrococcygeal teratoma. J Pediatr Surg 1990;25:1287 -91.
- (14) Brace V, Grant SR, Brackley KJ, Kilby MD, Whittle Ml: Prenatal diagnosis and outcome in sacrococcygeal teratomas: a review of cases between 1992 and 1998. Preitat Diagn 2000,20:51-55..
- (15) Brinker MR, Sheldin RG, Moynihan PC. Sacrococcygeai teratoma in children. J La State Med Soc 1989;141:26-31.
- (16) Buckley NJ, Burch WM, Leight GS. Malignant teratoma in the thyroid gland of an adult: a case report and a review of the literature. Surgery 1986; 100: 932-7.
- (17) Bude RO ,Rubin JM ,Adler RS: Power versus conventional colour Doppler sonography : Compression in the depiction of national international vasculature . Radiology 1922:777, 1994 .
- (18) Chiba T, Albanese CT, Jennings RW, et al. In utero repair of rectal atresia after complete resection of a sacrococcygeal teratoma. Fetal Diagn. Ther. 2000;15:187-190
- (19) Chisholm CA, Heider AL, Kuller JA, et al. Prenatal diagnosis

-
- and perinatal management of fetal sacrococcygeal teratoma. *Am J Perinatol* 1999;16:47-50.
- (20) Contribution of birth defects of infant mortality-United States, 1986, *MMWR Mort Wkly Rep* 38:633-635,1989.
- (21) Consolato S, Volker E, Bernhard B. Huge fetal sacrococcygeal teratoma with a completely formed eye and intratumoral DNA ploidy heterogeneity. *Pediatr Dev Pathol* 1999;2:507.
- (22) Cranston PE, Smith EE, Hamrick-Turner J. Emergence of mature teratoma following treatment of sacrococcygeal endodermal sinus tumour: CT and MR imaging with pathological correlation. *Pediatr Radiol* 1994;24:239-40.
- (23) Crussi FG, Winkler RF, Mirkin DL. Sacrococcygeal teratoma in infant and children. *Arch. Pathol Lab Med* 1978; 102:420-5.
- (24) Dewan P.A., Davidson, P.M. Campbell, P.G. Sacrococcygeal teratoma; has chemotherapy improved survival? *J. Pediatr. Surg.*, 22:274-277,1987.
- (25) Dillard, B.M., Mayer, J.H., McAlister, W.H., McGravrin, M and Strominger, D.B. Sacrococcygeal teratoma in children. *J. Pediatr. Surg.*, 5:53-59,1970.
- (26) Donnellan WA, Swenson O. Benign and malignant sacrococcygeal teratoma. *Surgery* 1968;64:834-836
- (27) Dunn CJ, Nguyen DL, Leonard JC. Ultrasound diagnosis of immature cervical teratoma: a case report. *Am J Perinatol* 1992; 9 445-7.
- (28) Dymling SO, Person HW, Hertz CH: Measurement of blood perfusion in tissue using ultrasound. *Ultrasound Med Biol*
-

17:433,1995 .

- (29) Ein SH, Adeyemi SD, Mancer K. Benign sacrococcygeal teratoma in infants and children: a 25 year review. *Ann Surg* 1980;191:382-4.
- (30) Ein SH, Mancer K, Adcycmi SO: Malignant sacrococeygeal teratoma-endodermal sinus, yolk sac tumor—in infants and children. A 32-year review. *J. Pediatr Surg* 20:473-477, 1985.
- (31) Engelskirchen R, Holschneider AM, Rhcin R, et al, Sacrococcygeal teratomas in children. An analysis of long term results in 87 children. *Z Kinderchir* 1987 ,42:358 -61.
- (32) Flake AW, Harrison MR, Adzick NS, et al. Fetal sacrococcygeal tera toma. *J. Pediatr. Surg.* 1986;21:563-566.
- (33) Flake AW. Fetal sacrococcygeal teratoma. *Semin. Pediatr. Surg.* 1993; 2:113-120.
- (34) Flamer D (1998):fetal surgery .A brief review .*pediatric radiol*,28:409-4.
- (35) Fraser GC, Blair GK, Le Blank, et al: The use of cardiopulmonary by-pass and circulatory arrest in the resection of massive tumors. *JPediatr Surg* 23:777-778,1988.
- (36) Fraumeni JF. Miller RW, Hill JA. Primary carcinoma of the liver in children: an epidemiologic study. *./ Nail Cancer Inst* 1968; 40: 1087-99.
- (37) Gale GB, D'Angio G, Uri A, Chatten J. Koop CE. Cancer in neonates: The experience at the Children's Hospital of Philadelphia. *Pediatrics* 1982; 70: 409-13. Crom DB, Wilimas JA, Green AA. Pratt CB, Jenkins JJ, Behm FG. Malignancy in the neonate. *Med Pediatr Oncol* 1989; 17: 101-4.'

-
- (38) Garcia AM, Morgan WM, Bruner JP. In utero decompression of a cystic grade IV sacrococcygeal teratoma. *Fetal Diagn Ther* 1998;13:305-8.
- (39) Garmel SH, D'Alton ME: Diagnostic ultrasound in pregnancy: An over view, *Seminperinatol* 18:117-132, 1994.
- (40) Goel A, Vasishta RK, Joshi K, : Prenatal percutaneous needle drainage of cystic sacrococcygeal teratomas. *J Pediatr Surg* , 34 (7): 1148-51,1999.
- (41) Gonzalez - Crussi F, Winkler RF, Mirkin DL: Sacrococcygeal teratomas in infants and children. Relationship of histology and prognosis in 40 cases. *Arch. Pathol. Lab. Med.* 102:420-425,1978.
- (42) Gonzalez-Crussi F. Extragonadal teratomas. *Atlas of Tumour Pathology*, second series, fascicle 18. Washington DC: Armed Forces Institute of Pathology, 1982; 48.
- (43) Goto M, Makino Y, Tamura R, et al. Sacrococcygeal teratoma with hydrops fetalis and bilateral hydronephrosis. *J. Perinat. Med.* 2000;28: 414-418
- (44) Graf JL, Albanese CT, Jennings RW, et al. Successful fetal sacrococcygeal teratoma resection in a hydropic fetus. *J. Pediatr. Surg.* 2000;35:1489-1491.
- (45) Graf JL, Housely HT, Albanese CT, et al. A surprising histological evolution of preterm sacrococcygeal teratoma. *J Pediatr Surg* 1998;33:177-9.
- (46) Grosfeld JL, Ballantine TVN, Lowe D. Benign and malignant teratomas in children: analysis of 85 patients. *Surgery* 1976;80:297-305.
- (47) Gross SJ, Benzie RJ, Sermer M, et al. Sacrococcygeal

-
- teratoma: prenatal diagnosis and management. Am J Obstet Gynecol 1987;156:393-6.
- (48) Gross RE, Clatworthy HW, Meeker IA. Sacrococcygeal teratoma in infants and children: report of 40 cases. Surg Gynecol Obstet 1951;92:341-52.
- (49) Hall R, Johnson M. Long term follow-up of untreated sacrococcygeal teratoma diagnosis in a twin of full-term gestation. J Diap Med SfJmtgraphy 2002; 18(3): 144-149.
- (50) Hawkins EP, Finegold MJ, Krischer IP, Starling KA, Weinberg A: Nongerminomatous malignant germ cell tumors in children. A review of 89 cases from pediatric oncology group, 1971-1984. Cancer 58:2579-2584, 1986.
- (51) Hedrick MH, Flake AW, Cromblehome TM, Hawell LJ, Johnson MP, Azdicks NS, et al (2004): sacrococcygeal teratoma: prenatal assessment, fetal intervention and outcome. 2004.
- (52) Hedrick MH, Longaker MI, Harrison MR (1999): Fetal surgery: state of the art in: Michael IB, eds. Pediatric plastic surgery III. USA: Appleton and Loange Asimon and Schuster Company, 695-722.
- (53) Hendren, W.H. and Henderson, B.M: the surgical management of sacrococcygeal teratomas with intrapelvic extension. Ann. Surg., 171:77-84, 1970.
- (54) Holterman AX, Filiatrault D, Lallier M, et al. The natural history of sacrococcygeal teratomas diagnosed through routine obstetric sonogram: a single institution experience. J Pediatr Surg 1998;33:899-903.
- (55) Holzgreve W, Mahony BS, Glick PL, et al.

Sonographic demonstration of fetal sacrococcygeal teratoma. *Prenat. Diagn.* 1985;5:245-257

- (56) Hood DL, Petras RE, Grundfest-Bronialowski S, Jagelman DG: Retrorectal cystic hamartoma. Report of five cases with carcinoid tumor arising in two (abstract). *Am J Clin Pathol* 89:433. 1988.
- (57) Izant RJ, Filston HC. Sacrococcygeal teratomas: analysis of 43 cases *Am J Surg* 1975;130:617-21.
- (58) Jain SP, Fan PH, Philpot EF, et al: Influence of various instrument settings on the flow information derived from the power mode. *Ultrasound Med Biol* 17:49, 1991.
- (59) Jones, P.G. and Campbell, P.E. *Tumours of Infancy and Childhood*, Blackwell Scientific Publications, Oxford, PP, 683-721, 1993.
- (60) Juric-Lekic G, Trosic M, Svajger A. Lentinoids within sacrococcygeal teratoma: origin by transdifferentiation? *Hum Pathol* 1993;24:227-9.
- (61) Kamata S, Imura K, Kubota A, Sawai T, Nose K, Hasegawa T, et al: Operative management for sacrococcygeal teratoma diagnosed in utero. *J Pediatr Surg* 2001;36(4):545-548.
- (62) Kaplan CG, Askin FB, Benirschke K Cytogenetics of extra gonadal teratology 19:261-266, 1979.
- (63) Kay S, Khalife S, Laberge JM, Shaw K, Morin L., : Laparoscopic clipping of the median sacral artery in huge sacrococcygeal teratoma, *Surg Endosc* 12 (6): 882-3, 1998.
- (64) Keslar PJ, Buck JL, Suarez ES. Germ cell tumors of the sacrococcygeal region: radiologic-pathologic correlation.

Radiographics 1994;14 :607- 22.

- (65) Kirk, D. and Lister, J: Urinary complications of Sacrococcygeal teratoma. *Z Kinderchir.*, 18:294-304,1976.
- (66) Kirkinen P, Heinonen S, Vanamo K, Ryynanen M. Maternal serum alpha-fetoprotein and epithelial tumour marker concentrations are not increased by fetal sacrococcygeal teratoma. *Prenat Diagn* 1997; 17:47-50.
- (67) Kohga S, Nambu T, Tanaka K. Hypertrophy of placenta and sacrococcygeal teratoma. *Virchows Arch A* 1980;386: 223-9.
- (68) Krasna IH, Lee ML, Smilow P et al. Risk of malignancy in bilateral streak gonads. The role of Y chromosome. *J Pediatr surg* 1992,27.1376-80
- (69) Kum CK, Wong YC, Prabhakaran K. Management of fetal sacrococcygeal teratoma. *Ann Acad Med* 1993;22:377-80.
- (70) Lack EE, Glaun RS, Hefter LG, Seneca RP, Steiman C, Athan F: late occurrence of occurrence of malignancy following resection of histologically mature sacrococcygeal teratoma. Report of a case and literature review. *Arch. Pathol. Lab. Med.* 117:724-728,1993.
- (71) Lahdenne P, Dunkel L, Heikinheimo M, et al. Hypergonadotropic hypogonadism and sperm abnormalities with benign sacrococcygeal teratoma . *J Androl* 1991 ;12:226 30.
- (72) Lahdenne P, Heikinheimo M, Jaaskelainen J, et al. Vertebral abnormalities associated with congenital sacrococcygeal teratomas. *J Pediatr Orthop* 1991;11:603-7.
- (73) Lahdenne P, Heikinheimo M, Periko M. Cell differentiation in a sacrococcygeal teratoma. An immunohistochemical and

-
- follow up study. *Pathol Res Pract* 1990;186:336-43.
- (74) Lahdenne P, Heikinheimo M, Xikkanen V, et al. Neonatal benign sacrococcygeal teratoma may recur in adulthood and give rise to malignancy. *Cancer* 1993;72.; 1727 ; 1731.
- (75) Langer JC, Harrison MR, Schmidt KG, et al. Fetal hydrops and death from sacrococcygeal teratoma: rationale for fetal surgery. *Am. J. Obstet. Gynecol.* 1989;160:1145-1150
- (76) Leung AKC, Rubin SZ, Seagram GF, et al. Sacrococcygeal teratoma. *Aust Paediatr J* 1985;21:123 5.
- (77) Levy FH, O'Rourke PP, Crone RK: Extracorporeal membrane oxygenation, *Anesth Analg* 75:1053-1062,1992.
- (78) Lineaweaver WC, Urunson MB, Smith. Pranjini DA, Runiley Id ,carcinoma arising in a pilonidal sinus. \ *Surg Oncol* 27:239-242. 19K4
- (79) Ling EWY: Frequency and load of congenital anomalies in a neonatal intensive care unit, prenatal diagnosis, and perinatal management. *Seminperinatol* 16:352-357,1992.
- (80) Mackenzie,Tippi C, Adzick NS (2001):Advances in fetal surgery.16(6):251-262.
- (81) Malone PS, Kiely EM, Brereton RJ, et al: The functional sequelae of sacrococcygeal teratoma. *J Pediatr Surg* 25:679-680,1990.
- (82) Mann JR. Germ cell tumours of childhood. In: Souhami RL, Tannock I, Hohenberger P, Horiot J-C, eds. *Oxford Textbook of Oncology*, 2nd edn. Oxford: Oxford University Press, 2002; 2638-55.
- (83) McDermott NC, Newman J: Tailgut cyst (retrorectal cystic hamartotna).prominent glomus bodies. *Histopathology* 18:265-266,

-
- 1991.
- (84) Moazam F, Talbert JL. Congenital anorectal malformations; harbingers of sacrococcygeal teratomas. *Arch Surg* 1985; 120:856-9.
- (85) Murphy JJ, Blair GK, Fraser GC. Coagulopathy associated with large sacrococcygeal teratoma. *J Pediatr Surg* 1992;27: 1308-10.
- (86) Musci MN, Clark MJ, Ayers RE, et al. Management of dystocia caused by a large sacrococcygeal teratoma. *Obstet. Gynecol.* 1983;62:108-128
- (87) Nakashima N, Fukatsu T, Nagasaka T, Sobuc M, Takeuchi J: The Irenua, and histology of hepatic tissue in germ cell tumors *Am J Surg Pathol* 1H,r 692. 1987.
- (88) Newman JS ,Adler RS ,Bude RO ,et., al :Detection of soft tissue hypereamia :Value of power Doppler sonography *AJR* 163:385 , 1994
- (89) Noseworthy J,Lack EE. Kozakewich HPW, Vawter GF, Weleh KJ: Sacrococcygeal germ cell tumors in childhood. An updated experience with 118 patients. *J.Pediatr. Surg.* 19:358-364,1981.
- (90) Paek BW, Jennings RW, Harrison MR, et al. Radiofrequency ablation of human fetal sacrococcygeal teratoma. *Am. J. Obstet. Gynecol.*2001;184:503-507.
- (91) Parizek J, Kemecek S, Pospisilova B, et al. Mature sacrococcygeal teratoma containing the lower half of a human body.*Child Nerv Syst* 1992;8:108-10.
- (92) Quintero RA,Hume R ,Smith C (1995) :precancerous fetal cystoscopy and endoscopic fulgeration of posterior urethral valves.

Am J Obstet Gynecol;97:477-481.

- (93) Rescorla FJ, Robert SS, Arnold GC, et al. Long-term outcome for infants and children with sacrococcygeal teratoma: a report from the Children's Cancer Group. J Pediatr Surg 1998;33:171-6.
- (94) Richards, T., Stricke, L. and Spitz, L: Sacrococcygeal chordomas in children. J. Pediatr. Surg: 8, 911-914, 1973.
- (95) Rintala R, iJahdenne P, Lindahl H, et al. Anorectal function in adults operated for a benign sacrococcygeal teratoma. J Pediatr Surg 1993;28:1165-7.
- (96) Ritchey ML, Azizkhan RG. Beckwith JB, Hrabovsky EE, Haase GM. Neonatal Wilms' tumor. , Pediatr Surg 1995; 30: 856-9.
- (97) Robertson FM, Crombleholme TM, Frantz ID. Devascularization and staged resection of giant sacrococcygeal teratoma in the preterm infant. J Pediatr Surg 1995;30:309- 11.
- (98) Rowe MI, ONeill JA, Grosfeld JL, Fonkalsrud EW, Coran AC Teratomas and germ cell tumors. In: Rowe MI, ONeill JA, Grosfeld JL, Fonkalsmd EW, Coran AG (eds) Essentials of Pediatric Surgery. Si Louis, CV Mosby, 1995: Ch 30.
- (99) Rubin JM ,Bude RO , Carson PL et., al :Power Doppler US :A potentially useful alternative to mean frequency –based color Doppler US Radiology 190:853, 1994 .
- (100) Schmidt KG, Silverman NH, Harrison MR, et al. High-output cardiac failure in fetuses with large sacrococcygeal teratoma: diagnosis by echo-cardiography and Doppler ultrasound. J. Pediatr. 1989;114:1023-1028
- (101) Schneider DT, Behnisch W, Calaminus G etal. Acute

-
- myelogenous leukemia after treatment for malignant germ cell tumors in children. J Clin Oncol 1999; 17: 3226-33.
- (102) Schropp KP, Lobe TE, Rao B, et al: Sacrococcygeal teratoma: the experience of four decades. J Pediatr Surg 27: 1075-1079,1992.
- (103) Shaaban AF,Baekim H, Flake AW (2003):fetal surgery,diagnosis and interventionin: Waber TR ,Azizkhan RG, Zeigher MN, eds .Operative pediatric surgery .USA :Magraw-Hill company;21-35 .
- (104) Sherowsky RC, Williams CIT, Nichols VB, et al: Prenatal ultrasonographic diagnosis of a sacrococcygeal teratoma in twin pregnancy. J.Ultrasound. Med 4:159,1985.
- (105) Subbarao P, Bhatnagar V, Mitra DK. The association of sacrococcygeal teratoma with high anorectal and genital malformations. Aust NZ J Surg 1994;64:214-15.
- (106) Svesko, H. Teratoma regionis cocygealis, Gynaecologia-135:153,1953.
- (107) Tagart R1.1V. Congenital anal duplication. A cause of para-anal sinus. Ur Sm 64:525-528, 1977.
- (108) Tapper, D.and Lack, E.E. Teratomas in infancy and childhood. FA54-year experience at the children's Hospital Medical Center. Ann. Surg., 1983: 398-410,1983.
- (109) Teitelbaum D, Teich S, Cassidy S, et al. Highly vascularized sacrococcygeal teratoma: description of this atypical variant and its operative management. J Pediatr Surg 1994;29:98-101.
- (110) Thomas MK (1995) : principles of fetal surgery :spitz L, Coran

-
- AG ,eds.Rob and Smith operative pediatric surgery 2 (5) .London: Chapmin and Hall Medical ;847-857 .
- (111) Tsuchida Y, Endo Y, Saito S et al. Evaluation of alpha-fetoprotein in early infancy. J PediatrSurg 1978; 13: 155-6.
- (112) Tsuchida Y, Hasegawa H: The diagnostic value of alpha fetoprotein in infants and children with teratomas: A questionnaire Survey in Japan. J PediatrSurg 18:152,1983.
- (113) Valdiserri RO, Yunis EJ. Sacrococcygeal teratomas: a review of 68 cases. Cancer 1981;48:217-221
- (114) Ville Y, Hyett JJecker K, Nicolaides K: Preliminary experience with endoscopic laser Surgery for severe twintwitf transfusion Syndrome. N.Engl. J.Med, 332:224-227,1995.
- (115) Vogl D, Riel KA. Prasakraler Tumor mit sakraler Menin-gozele. ZKinderchir 1988; 43,361;4.
- (116) Westerburg B, Fckktein VA, Sandberg PL, Lopoo JB, Harrison MR, Albaaese CT: Sonographic prognostic factors in fetuses with sacrococcygeal teratoma. J Pediatr Surg 2000;35(2):322-326.
- (117) Whalen TV Jr. Maliour GH, Landing BH, Woolley MM: Sacrococcygeal teratomas in infants and children. Am. J. Surg. 150:373-375,1985.
- (118) Yuen BH, Mincey EK. Human chorionic gonadotropin, prolactin, estriol, and dehydroepiandrosterone sulfate concentrations in cord blood of premature and term newborn infants: Relationship to the sex of the neonate. Am J Obstet Gynecol 1987;156:396-400.

الملخص العربي

يتكون الورم المسخي من عدة أنسجة مختلفة عن أماكنها التشريحية المتعارف عليها مرتبة بصوره عشوائية فهي تنشأ من خلايا جنينية متعددة و على حسب درجة النمو ينقسم أنواع هذا الورم إلى كامل النمو و غير كامل النمو و سرطاني.

الخلايا المتعدد الصفات موجودة طبيعيا في الأعضاء التناسلية و من الممكن أن تتواجد أيضا في منتصف الجسم و لهذا فهي تتواجد في المبيض — الخصية ، الصدر ، وراء غشاء البريتون و العجز و العصعصة و داخل المخ.

ينشأ الورم المسخي العجزي العصعصي من عقدة هنسون التي تبدأ في النمو تجاه العصعصة فتتمو إلى الخلف و إلى الأسفل تجاه الخاصرتين و إلى الأعلى تجاه تجويف البطن. الورم المسخي العجزي العصعصى لديه القدرة على الانقلاب إلى ورم سرطاني مع مرور العمر و لكن الأورام الحميدة هي الأغلب.

يظهر هذا الورم بعد الولادة مباشرة في صورة ورم خلف العجز في منتصف الجسم و ممكن أن يظهر أيضا في صورة ناصور مزمن أو ألم في أسفل الظهر أو انسداد في مجرى البول أو مجرى الجهاز الهضمي.

في بعض الأحوال يكون هذا الورم سببا في صعوبة و انسداد الولادة و من الممكن أيضا أن يكون هذا الورم مسئولا عن ترحيل المستقيم أماما و الضغط على المثانة و جدار البطن . تعد الأشعة المقطعية و الرنين المغناطيسي من أهم الطرق لتشخيص هذا الورم و تقدير التوغل داخل الحوض .

يعد التشخيص المبكر لهذا الورم بالأشعة التليفزيونية أثناء الحمل من الأشياء المهمة حتى يتمكن من خلالها توافر مكان مناسب للولادة و مكان مجهز لمثل تلك الحالات و الولادة القيصرية من الإحتياجات المطلوبة للحفاظ على حياة الطفل و منع التزيف .

الجراحة هي الحل الأمثل لمثل هذا الورم مع استئصال للعظمة العصعصية مع مراعاة العلاج الكيماوي و الإشعاعي بعد العملية و جراحة الأجنة من الصيحات الحديثة في علاج هذا الورم مع التشخيص المبكر لها .

رسالة ماجستير فى الجراحة العامة

الورم المسخى العجى العصى

الباحث الطبيب/- اشرف محمود صفوت عبد الحميد

لجنة الإشراف

د. / ناظم محمد على شمس أستاذ جراحة الاورام كلية الطب جامعة المنصورة	د. / عادل طه دنيور أستاذ و رئيس وحدة جراحة الاورام كلية الطب جامعة المنصورة
---------------------------------------------------------------------------	-----------------------------------------------------------------------------------

د/محمد عبد الفتاح حجازى

مدرس جراحة الاورام

كلية الطب جامعة المنصورة

المشرف الرئيسى

د. / عادل طه دنيور

أستاذ و رئيس وحدة جراحة الاورام

كلية الطب جامعة المنصورة