CASE REPORT

# Ultrasound and magnetic resonance imaging utilisation in diagnosing a sacrococcygeal teratoma: Diagnostic imaging case report from Malawi

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## ABSTRACT

This diagnostic imaging case report details how ultrasound (US) and magnet resonance imaging (MRI) were used in diagnosing sacrococcygeal teratomas in a newborn postnatally. Sacrococcygeal teratomas are rare congenital tumours with an incidence of 1 in 20000-40000 live births, often detected prenatally through routine obstetric ultrasound and foetal magnetic resonance imaging (MRI) but some remain undetected until birth. While the combination of ultrasound and MRI is standard in high-income countries, this case is notable for its low-resource context. In this diagnostic imaging case report, we highlight the application of these techniques in Malawi, where accessing advanced imaging is limited. Using the information from ultrasound and MRI for surgical planning, the infant underwent an elective excision of the tumour, which was performed successfully and without complications. This diagnostic imaging case report underscores the critical role of medical imaging in tumour characterisation and surgical planning and the importance of effectively utilising available resources to achieve accurate diagnoses even in settings with constrained medical infrastructure. It also highlights the challenges associated with the prenatal diagnosis of congenital abnormalities, such as sacrococcygeal teratomas in Malawi, which is hampered by a critical shortage of sonographers and radiologists resulting in late detection and delayed reporting of radiology examinations, impacting the treatment process and the continuity of care. Therefore, strengthening radiology infrastructure, training, and referral systems to MRI capable facilities should be prioritised to improve early and accurate diagnosis of sacrococcygeal teratomas and other complex conditions.

## INTRODUCTION

Sacrococcygeal teratomas (SCT) are the most common congenital (present at birth) extragonadal germ cell tumours occurring at the base of the sacral

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spine and buttocks, with an estimated incidence of 1 in 20000-40000 live births[1,2]. These tumours originate from the three germinal layers and may include neural elements, squamous and intestinal epithelium, skin appendages, teeth, and occasionally calcium[2]. They occur more frequently in female babies than in male babies, with a ratio of 3:1; however, they tend to be more malignant in the male population[3]. Based on their morphological appearance in medical images, sacrococcygeal teratomas (SCTs) are classified into four types based on the Altman classification system. Type I is predominantly external, Type II has a dumbbell shape with roughly equal internal and external components, Type III is mainly internal, and Type IV is entirely internal[4].

In high-income countries (HIC), routine foetal anomaly scans conducted between 18 and 22 weeks of gestation allow for the early detection of SCTs. This early detection facilitates prenatal monitoring and enables planning for delivery at specialised centres[5]. In low-income countries like Malawi, variability in prenatal screening protocols and limited access to quality prenatal care that includes medical imaging leads to missed opportunities for early diagnosis of congenital anomalies[6]. Where available, postnatal ultrasound (US) and foetal magnetic resource imaging (MRI), play a crucial role, offering detailed anatomical and imaging characterisation of tumours like SCT, assessing potential spinal involvement and aiding in surgical planning[7].

In this diagnostic imaging case report, we present a rare instance of sacrococcygeal teratoma (SCT) in an infant, diagnosed postnatally through ultrasound and MRI in Malawi. Although the exact prevalence of SCT in the country is unknown, limited access to prenatal imaging likely results in underdiagnosis and delayed interventions. The shortage of sonographers and radiologists further exacerbates this issue. To the authors' knowledge, this is the first documented case involving ultrasound and MRI in diagnosing SCT in Malawi and this is the focus of this imaging case report.

## IMAGING CASE PRESENTATION

A 3-day-old full-term female infant was referred from a health centre (HC) in Lilongwe with a history of a large mass in the sacral region in January 2025. The infant was delivered through spontaneous vaginal delivery (NVD) to a 19-year-old primigravida with no known family risk factors of congenital anomalies or maternal complications. The birth weight was 3700g. The extent of antenatal care the mother received was unclear; however, it was confirmed that she did not have any ultrasound. According to the clinical examination findings on the day of arrival, the infant was pink and alert and maintained a normal body temperature of 36.9$^0$C at room temperature. She was saturating at 97% in room air and had a pulse rate of 145 beats/min. Physical examination notes indicated a soft, non-tender abdomen with no signs of distended internal organs. The anus was patent, not displaced but smaller in size. Additionally, there was a shiny mass with an area of ulceration protruding from the sacrococcygeal region (Figure 1).

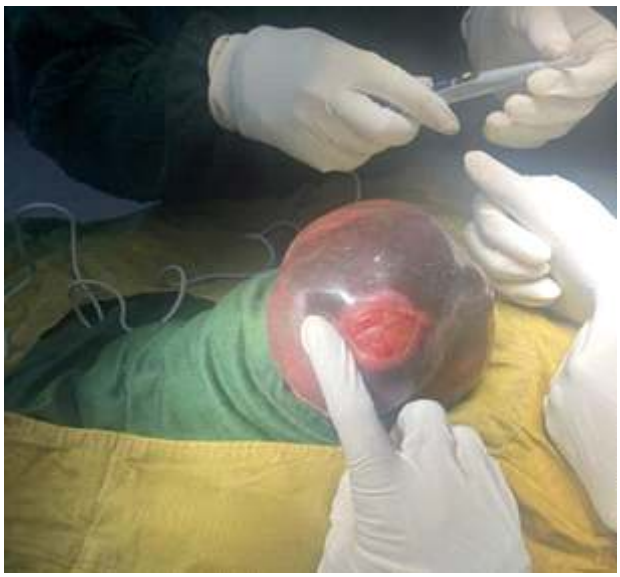

**Figure 1:** A photograph showing a shiny mass with an area of ulceration before surgical resection

Normal limb movement, spontaneous urination and defecation, and no signs of neurological deficits were present. The mass raised suspicion of a

congenital tumour. The provisional diagnoses included myelomeningocele (MMC) and teratoma, prompting further evaluation via medical imaging due to the absence of a prenatal diagnosis. Due to the urgent nature of the case, the attending surgeon requested an urgent ultrasound examination to be performed on the same day to determine the nature of the sacral mass.

**Ultrasound examination**

The infant was presented to the radiology department, where a radiology resident performed an ultrasound of the abdomen and pelvis. This confirmed a complex mass with both cystic and solid components, and subtle signs of extension into the pelvic cavity, displacing the pelvic contents anteriorly. The mass appeared infiltrative, raising suspicions about an MMC or SCT. However, the true extent of the lesion and potential intraspinal involvement were unclear, necessitating further imaging with MRI. The rest of the abdomen and pelvic contents were unremarkable. The infant was to be kept nothing by mouth (NPO) from the morning of the second day of admission pending MRI findings.

**Magnetic resonance imaging (MRI) examination**

On the second day of admission, a high-resolution, non-contrast, non-sedation MRI of the lumbosacral spine and pelvic region was performed on a 1.5 Tesla machine for a comprehensive assessment. The attending clinicians interpreted the MRI images due to inadequate radiologists. The size and position of the mass presented challenges during the MRI imaging examination. The infant was positioned in the right lateral decubitus, wrapped in a cloth (chitenge), and immobilised using accessory bands and cushions. A routine musculoskeletal MRI protocol including T1, T2, Proton density and fat-saturated images was obtained (Figure 2).

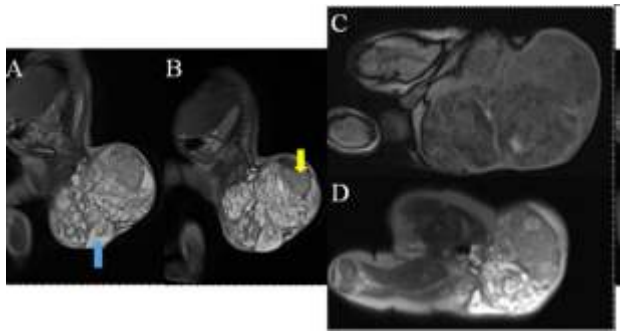


**Figure 2:** Sacrococcygeal teratoma in a female neonate. T2W sagittal images show a predominantly external fatty mass (Type I) and T2 hyperintense cystic areas (blue arrow) alongside solid components (yellow arrow)

The MRI showed a well-defined mixed signal (fat, solid and cystic components) sacrococcygeal space-occupying mass measuring 12.4 cm by 9.3 cm. The mass exhibited distinct characteristics, including multiple septations and loculations, alongside a predominant T2 shortening. It had well-defined margins and did not exhibit any extension into the pelvic cavity, but showed mild anterior displacement of the pelvic contents. The larger portion of the mass remained confined to the exterior consistent with Type I SCT as outlined in the Altman classification[7]. No other abnormalities were observed.

**Management and outcome**

On the second day of admission, the infant successfully underwent an MRI, and the attending clinicians interpreted the MRI images to confirm the diagnosis of SCT and its anatomical location. Later that afternoon, the infant had an elective excision of the tumour, which was performed without complications. (Figure 3). This is the recommended treatment for SCT in children [8]. A sample tissue was sent for histopathological examination to confirm the findings and nature of the teratoma (benign/malignant). The postoperative course was uneventful. No immediate post-operative imaging was required. The infant was discharged after a

week's stay in hospital. As in similar cases of Neonatal SCT without complication, close monitoring and follow-up imaging were recommended if any complication would arise.

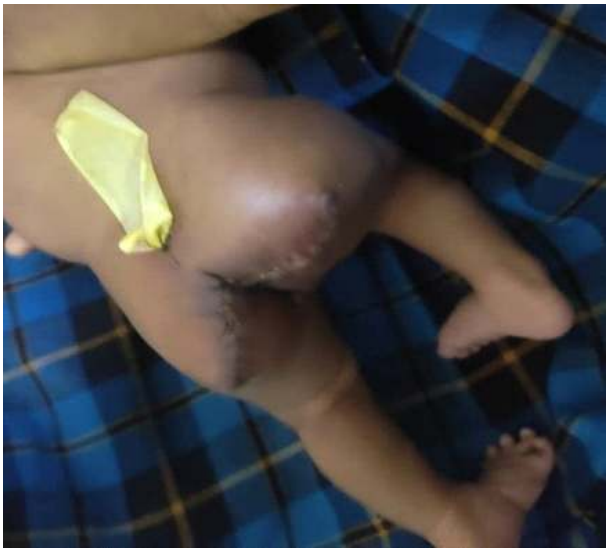

**Figure 3:** A photograph of the baby showing the sacral region after the removal of the mass

## DISCUSSION

In this diagnostic imaging case report, we report the role ultrasound and MRI played in diagnosing a sacrococcygeal teratoma (SCT) in a newborn referred from a health centre (HC) in Malawi. In the Malawian context, HCs are lower-level public health facilities that provide primary care services, including antenatal care, and also function as referral centres for secondary-level district hospitals and tertiary central hospitals[9]. The World Health Organization (WHO) recommends that pregnant women have at least an ultrasound scan before 24 weeks of gestation. This scan helps estimate gestational age, detect foetal anomalies and multiple pregnancies, reduce the need for labour induction in post-term cases, and improve the overall pregnancy experience[10].

The Association of Obstetricians and Gynaecologists of Malawi (AOGM) recommends performing serial antenatal ultrasounds to monitor pregnancies[11]. However, the Malawi National Reproductive Health Service Delivery Guidelines produced by the Ministry of Health do not include prenatal imaging in the recommended tests. This omission limits the routine detection of congenital abnormalities despite the nation having 97% antenatal coverage[12]. Prenatal ultrasound is provided at no cost in the public healthcare system; however, implementing routine antenatal ultrasound varies by facility, leading to discrepancies between recommended care and the actual services offered[11]. This variation stems from factors such a lack of awareness among both women and healthcare providers, the absence of clear obstetric ultrasound guidelines, and a significant shortage of skilled sonographers who can identify congenital abnormalities. When this imaging case report was written, there were only six qualified sonographers in the country, resulting in a considerable gap in expertise. To overcome this challenge, the Malawi University of Science and Technology (MUST) launched the bachelor's and master's degrees ultrasound programmes in 2022[13].

If prenatal detection of SCT has not happened, it can result in significant consequences for the newborn, including the risk of extensive bleeding from tumour rupture[1]. Ultrasound is frequently the first imaging technique chosen for its accessibility and safety profile[1,14]. Ultrasound does not use ionising radiation, making it safer for children whose tissue and organs are more sensitive to ionising radiation exposure [14,15]. Children have a higher average risk of developing cancer compared with adults receiving the same radiation dose[16]. In our case, ultrasound distinguished the tumour's size, complex composition (solid, cystic and mixed components), and vascular characteristics of SCT[4]. In addition, ultrasound helped to detect possible pelvic extension and differentiated the SCT from other congenital masses. However, it is difficult to distinguish SCT's fat components from normal fat using ultrasound alone, and it is also operator-dependent[1,2]. In this case report, an MRI

examination was requested and conducted to address these inherent limitations of ultrasound.

After inconclusive results from ultrasound, MRI became the second and most definitive postnatal imaging method, similar to other documented cases of SCT[4,7]. Despite its limitations, such as the impact of patient movement on image quality and long scan time which can be challenging in infants, MRI offered superior soft tissue contrast and multiplanar imaging[16]. MRI's good spatial resolution enabled the accurate assessment of the tumour's size and borders, confirming its extra-pelvic location as illustrated in Figure 2 (A & B). MRI further confirmed the tumour's fat, cystic, and solid components, findings in keeping with SCT[3,4,7,17]. MRI also ruled out major infiltration to the adjacent spinal structures, information crucial for surgical planning[18]. MRI is a non-ionizing imaging method, making it safe for children, similar to ultrasound. However, in Malawi, access to MRI is limited due to the scarcity of MRI equipment and the high cost associated with MRI examinations. When this imaging case report was written, the only two MRI scanners in the nation were located in Lilongwe. This is significantly below international recommendations for meeting the growing demand for MRI services. Improving access to this advanced medical imaging is essential.

In our case, reporting on the MRI examination was delayed until after the surgery due to a critical shortage of radiologists as there were only 4 radiologists in the country servicing a population of 20 million[19]. This equates to one radiologist for every five million people compared to around 9.9 radiologists per 100,000 in the United Kingdom (UK)[21]. Due to this shortage of radiologists, clinicians are responsible for interpreting plain film examinations. This increases the likelihood of missed diagnoses, as they may lack the training for such extended roles[20]. To overcome this challenge, Kamuzu University of Health Sciences (KUHeS) established a postgraduate radiology programme in 2022. Other solutions include teleradiology reporting and developing extended roles for radiographers to interpret medical images. Recent research by Simwaba et al. (2024) found positive perceptions among most radiographers about reporting chest images in Malawi[21]. Further research and stakeholder engagement are necessary before expanding the scope of practice for radiographers to include image reporting.

In this presented case, once SCT was confirmed through ultrasound and further evaluated with MRI, surgical intervention was planned as early as possible to reduce morbidity and mortality. The tumour was removed entirely to reduce the risk of recurrence. However, the lack of dedicated cancer hospitals in Malawi presents significant challenges in managing tumour cases with malignant potential. Surgical resection is usually sufficient for benign SCT[1]. However, the malignant type requires additional treatment such as chemotherapy and long-term oncological follow-up to about five years of age, which is difficult to access within the country[7]. The Malawian Government is establishing the first dedicated cancer treatment centre at Kamuzu Central Hospital in Lilongwe [22]. This will ensure more access to cancer treatment services and save money spent on sending patients abroad. At present, most cancer patients seek treatment in countries like India, South Africa, or Zambia which is costly and logistically challenging for a nation facing economic difficulties.

## RECOMMENDATIONS

Considering the limited ability to detect congenital abnormalities prenatally in Malawi without medical imaging and the delayed reporting of medical images, the following recommendations are proposed to enhance prenatal detection of congenital abnormalities and improve the outcomes for affected infants and families.

- **Enhance prenatal care:** Standardise protocols for prenatal screening to ensure consistent best practices among healthcare workers, implement community programs

to educate expectant mothers on the importance of prenatal imaging and early detection of congenital abnormalities, and strengthen referral pathways for high-risk pregnancies.

- **Enhance training and availability of prenatal medical imaging:** Enhance services by providing specialised training to clinicians, sonographers and radiographers, on prenatal screening and diagnostic techniques, while increasing the availability of ultrasound services in rural areas through mobile clinics and partnerships with local healthcare facilities**.**

- **Enhance radiology services:** Increase the number of radiologists and enhance teleradiology services to improve reporting times for medical images by allowing radiologists outside Malawi to review and report on critical cases.

## CONCLUSION

This case highlights the critical role of ultrasound and MRI in the postnatal diagnosis and management of sacrococcygeal teratoma in a low-resource setting, mainly when there was no prenatal detection. While prenatal diagnosis enables earlier intervention and delivery planning, gaps in access to foetal imaging remain a significant challenge in Malawi. Enhancing the availability and utilisation of advanced prenatal medical imaging, such as ultrasound and magnetic resonance imaging, is crucial for improving early detection, optimising perinatal care, and ensuring favourable outcomes for the affected infants.

## CONSENT FOR PUBLICATION

The patient's parent provided written informed consent for the publication of this case report and associated images. Additionally, the head of the department (HOD) at the hospital permitted using the images in this case report.

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