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Management of Renal Angiomyolipomas in Pregnancy: A Protocol is Needed

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Abstract: Angiomyolipomas (AMLs) are uncommon, benign tumours of the kidney that can be sporadic or associated with the Tuberous Sclerosis Complex (TSC). Individuals with AML can be asymptomatic, or present with life threatening perirenal bleeding. An association with rapid growth during pregnancy, has been identified, thought to be resulting from increased hormones antenatally. Having said that, existing literature lacks an established pathway in managing AML in pregnancy. Databases including PubMed (MEDLINE) and Google Scholar were browsed until May 2025, using the below keywords. The aim of this review article is to emphasise the importance of careful management of AML in pregnancy and aid in establishing a clear pathway that will help in minimising risk to both mother and foetus.

Keywords: *Angiomyolipoma, Renal Angiomyolipoma, Kidney Tumour, Renal Tumour, Angiomyolipoma in Pregnancy, AML Management.*

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I. INTRODUCTION

Grawitz first described AML in 1900 as a large renal tumour, composed of blood vessels, muscle and fat [1]. Hence its name. Though renal AML is the most common type, AMLs can also present in the pancreas or liver [2]. Renal AMLs can be sporadic or associated with Tuberous Sclerosis in patients with Tuberous Sclerosis Complex (TSC) [1]. Up to 3% of renal tumours, are found to be AMLs [2], with the prevalence being twice as common in females [3], making AML the most common benign renal tumour [4]. Most of AMLs are diagnosed incidentally, on radiological investigations performed for an unrelated reason [1].

AML complications can vary from patients being asymptomatic, to spontaneous life-threatening retroperitoneal haemorrhage, with increasing size being a major risk factor [5]. As some patient can be asymptomatic, monitoring AMLs is very important in minimising risk of serious complications. In certain cases, intervention is warranted. Well established indications for intervention include, symptomatic lesions, AMLs larger than 4cm and when malignancy is suspected [6].

Growth rate of AML is higher during pregnancy, thought to be driven by hormones [7]. Existing evidence suggests an accelerated growth during pregnancy, secondary to higher oestrogen levels, resulting in an increased risk for rupture [8]. Thus, management of AMLs becomes more challenging during pregnancy. Though there have been studies proposing surgical intervention, and particularly laparoscopic or more recently with robotic surgery becoming more readily available, robotic assisted laparoscopic surgery during the 2nd trimester or after 26weeks of gestation [9], to date there is no established pathway or protocol for management of AMLs in pregnancy.

The aim of this review article is to emphasise the importance of careful management of AML in pregnancy and aid in establishing a clear pathway that will help in minimising risk to both mother and foetus.

II. METHODS

We conducted a literature review of all available articles for renal AMLs, through databases including PubMed (MEDLINE) and Google Scholar. Databases were browsed until May 2025, using the following combination of keywords: [Angiomyolipoma OR renal angiomyolipoma OR kidney angiomyolipoma OR renal tumour OR kidney tumour OR AML management] AND [pregnancy]. This review article was primarily focused on renal AMLs and their management during pregnancy.

III. RESULTS

Though AMLs were first described over a century ago, there is still no protocol in managing renal AMLs. This is also true regarding the management of renal AMLs during

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pregnancy. With pregnancy being a high-risk period for the mother, despite renal AMLs being uncommon, in case of a symptomatic patient the outcome could be catastrophic for both the mother and foetus. Although not vast, there is evidence in the literature that laparoscopic as well as robotic nephrectomies can be performed safely during pregnancy. This is however, the most invasive option out of the traditional renal AML interventions and should only be performed when less invasive options such as embolization is not appropriate. Having said that, most of nephrectomies performed during pregnancy were performed for malignant tumours and not AMLs. Nonetheless, there have been cases within the last decade undergoing radical nephrectomies, for bleeding renal AMLs, with the foetus left in utero and proceeding to deliver at term with no complications. These cases are always best managed using a Multi-Disciplinary Team (MDT) approach. Nonetheless, a managing protocol will allow more clinicians to proceed with what is widely accepted as the safest option. This protocol should also be tailored according to the gestation week of the patient, as different risks to mother and foetus are involved in each trimester. The protocol will not only help clinicians but can also provide comfort and confidence to patients in such a critical time.

IV. DISCUSSION

Renal AML are uncommon benign tumours also known as renal hamartomas. Nonetheless, they still attribute to the most common benign renal tumour. It is estimated that 3% of renal masses are found to be AMLs [2]. AMLs can be divided into two types, classic and epithelioid [1], the latter showing more aggressive behaviour [10]. Around a fifth of AMLs are associated with TSC, however, the majority tend to be sporadic [11].

Though AMLs were first described over a century ago, there is still no protocol in managing patients with AMLs in pregnancy. Most of AMLs are diagnosed incidentally on scans performed for a different indication [3]. Having said that, it is not uncommon for patients to present with abdominal pain, flank pain and or haematuria [12]. Manifestation of symptoms is associated with location of the tumour, its size and or growth rate [13]. 15% of cases can present with retroperitoneal haemorrhage, the most serious complication, which can sometimes result in septic shock [5]. According to the literature, tumour size is a well-established risk factor for complications and most centres agree that intervention is warranted for symptomatic patients, tumour size greater than 4 cm and or in cases suspicious for malignancy [14]. Recommended management options for AMLs are summarised in Table 1 [15].

Diagnostic radiologic modalities include ultrasonography, Computed Tomography and Magnetic Resonance Imaging, with the first being the preferred first line investigation for renal tumours and the other two utilised when there is a diagnostic uncertainty or more information is needed [16]. In case of an AML with little or no adiposity, diagnosis becomes a challenge and in such cases a biopsy might be necessary to distinguish between benign and malignant pathology [17]. The presence of bilateral renal tumours can complicate the diagnostic process even further and careful approach within an MDT setting is recommended for these patients, or patients with risk factors for renal insufficiency. Interestingly, in almost up to 7% of post-operative histology reports the diagnosis is AML, though initially the tumour was thought to be malignant [18]. This highlights the importance of specialist imaging review with or without a renal biopsy to aid with clinical decision making.

More recently, Swärd et al, concluded that the long established 4cm cut off for intervention should be reconsidered [19]. In their study the tumours seen in TSC patients were larger compared to patients with sporadic AMLs, 11.4cm vs 6.0 cm, with no significant difference in bleeding observed [19]. More studies are needed to establish whether significant difference in bleeding can happen in tumours that are less than 4cm or whether a new cut off should be agreed.

Furthermore, Sward et al are suggesting that newer prognostic indicators such as the angiomyogenic component, composition of vasculature and smooth muscle compared to adipose tissue, should be used [19]. Interestingly, a significantly higher angiomyogenic component (23%) was seen in patients with bleeding AMLs, when compared with asymptomatic patients with AML that exhibited an angiomyogenic component of 8% [19]. Nevertheless, it would be interesting to see whether there is any association between the angiomyogenic component and AMLs <4cm.

Additionally, the risk of bleeding was found to be 13% in AMLs with angiomyogenic component of <5%, whereas the risk rose to 42% in AMLs with a component of ≥ 5% [19]. Although the presence of aneurysms, irrespective of the size, is a well-established risk for bleeding, this was not reflected in the study by Sward et al [19].

The more recent suggestion of the angiomyogenic component has yet to be studied during pregnancy. Though no protocol exists for AML management during pregnancy or not, as there is substantial evidence for managing non-pregnant patients most health boards are managing patients with the traditional approaches, as summarised in Table 1 [15]. Having said that, there have been cases in the literature with symptomatic AMLs during pregnancy, which in some cases can have catastrophic outcomes.

In 1856, Carl Reinhold August Wünderlich described Wünderlich syndrome [20], as a rare critical condition with spontaneous retroperitoneal haemorrhage associated with ruptured AMLs [21]. Wünderlich syndrome has a strong preponderance for women, with 75% of cases happening in female patients [22]. Despite the strong female preponderance, cases during pregnancy are very unusual having a negative impact on early diagnosis, with most clinicians having obstetric emergencies higher on their differentials, and subsequently maternal and foetal survival [23].

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The fact that AMLs are exceptionally rare in pregnancy, along with the ethical considerations with testing new interventions in such a high-risk group, means that a management protocol is extremely difficult to be established [24]. Despite the advancements in laparoscopic and more recently robotic surgery, to date there has been very few cases of robotic surgery for renal tumours during pregnancy, with most occurring for malignancy [25]. Evidence for those studies can aid in establishing a protocol for managing renal AMLs during pregnancy.

According to Loughlin et al., radical surgery should be offered for solid renal masses during first trimester or after 28 weeks of gestation, with foetal lung maturity being the discriminating factor for surgical intervention in the third trimester [26]. Nonetheless, there is still controversy in the literature with some surgeons prioritising maternal health and recommending an urgent nephrectomy irrespective of gestation [27,28,29].

Ultimately the decision lies with the pregnant patient [30], but it is important for clinicians to remember that not all renal masses identified during pregnancy warrant immediate surgical treatment [31]. Every decision should be carefully taken and based on the following factors: maternal and foetal outcomes, tumour aggressiveness and maternal choice [32]. The consensus is to avoid surgical intervention, in the first trimester, for localised (Stage I-II) renal tumours [33]. However, for advanced (Stage III-IV) tumours Slyusar and Dell'atti state that pregnancy termination should be considered to facilitate treatment of the tumour [25].

Finally, Dai et al., showed that a laparoscopic nephrectomy can be performed during pregnancy without adverse outcomes [34]. The same is true for robotic surgery, with literature showing no significant rise in the risk of preterm labour or other complications for either foetus or mother [35]. Preece et al. reported the first case of nephrectomy for a bleeding AML, in late second trimester with the foetus left in utero [12]. This was a 45-year-old, 25-weeks of gestation, who went on to deliver at term with no complications [12].

Table 1. Treatment Methods for Renal Angiomyolipoma

Tumor Characteristics	Recommended Management
Asymptomatic tumors smaller than 4 cm	Active Surveillance
Symptomatic tumors smaller than 4 cm	Cryoablation
Tumors larger than 4 cm or symptomatic tumors	Surgical Intervention
Tumors with a tendency to bleed	Selective Renal Artery Embolization

V. CONCLUSION

Renal AMLs are rare, benign tumours that are most of the times found incidentally and patients are predominantly asymptomatic. Having said that, there is a proportion of patients in which intervention is warranted. These involve cases where the patients are symptomatic, the AML is >4cm or when there is suspicion of malignancy. Although the aforementioned indications have traditionally been used in managing patients with renal AMLs, to date there is no established protocol and new studies suggest using the angiomyogenic component of the tumour to decide on management. Even more challenging becomes the management of renal AMLs identified during pregnancy, with aneurysmal rupture risk being higher secondary to increased maternal circulation and antenatal hormonal influence. This can have catastrophic effects on both mother and foetus. There are reports in literature regarding laparoscopic, and more recently, robotic surgery during pregnancy with no significant risks observed. The majority of these reports however, were performed for malignancy and not for benign AMLs.

To conclude, surgery in the form of laparoscopic with or without the use of a robot, can be performed safely during pregnancy in patients with bleeding renal AMLs. Pregnancy should not be a deterrent in performing radical surgery in patients with significant bleeding from renal AMLs. This review emphasises the need to establish a protocol in managing renal AMLs with or without a concomitant pregnancy. Further evidence will be fundamental in aiding tertiary centres and Urological Associations establishing a protocol. A multidisciplinary approach is necessary, with Obstetricians, Vascular Surgeons and Radiologists, in order to achieve the best possible outcomes, with the constraints of renal AMLs being uncommon along with the ethical considerations that arise with trials and research during pregnancy.

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Authors have no conflict of interest to declare.

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➢ *Ethical approval*
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➢ *Author contribution*
- Iosifidis – First author, literature Review.
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