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Case Report

Renal Cell Carcinoma in Pregnancy From a Gynecological Perspective: A Case Report and Review of Management Algorithm

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Abstract

Renal cell carcinoma (RCC) is a rare urological malignancy that may present during pregnancy. There is a lack of standardized management protocols, which makes RCC diagnosis and treatment challenging due to the need to balance maternal oncologic results and fetal safety. Using imaging modalities is restricted by the pregnancy-related limitations, and surgery carries the risk of preterm delivery. A multidisciplinary approach and minimally invasive technique had improved the outcome. A 25-year-old primigravida with 23 weeks of gestation reported left flank pain and hematuria. The ultrasonography showed a solid left renal mass of 4.5 by 4 cm, which was later defined using non-contrast MRI as suspicious of RCC. At 26 weeks, a left radical nephrectomy using a retroperitoneal approach was done under epidural anesthesia with close intraoperative supervision with obstetric standby following multidisciplinary consultation and informed patient consent. The surgery went smoothly with an intraoperative blood loss of 400 mL and stable maternal-fetal measurements. Diagnosis: Histopathology showed clear cell RCC, pT1bN0Mx, WHO/ISUP grade 2, with free margins. After an uneventful recovery, the patient delivered a healthy female child by caesarean delivery at the 38th week. RCC should be considered in pregnant women who report persistent urinary symptoms, hematuria, flank pain, or masses. Ultrasound continues to be the main diagnostic modality, with MRI having better tissue characterization without radiation exposure. A multidisciplinary decision-making process that is unique and considers the tumor biology, size, gestational age, and preferences of the patient will maximize both oncologic and obstetric results.

Keywords: MRI; Nephrectomy; Pregnancy neoplasm; Renal cell carcinoma; Ultrasound.

سرطان الخلايا الكلوية أثناء الحمل من منظور أمراض النساء: تقرير حالة ومراجعة خوارزمية الإدارة

الخلاصة

سرطان الخلايا الكلوية (RCC) هو ورم خبيث نادر في المسالك البولية قد يظهر أثناء الحمل. هناك نقص في بروتوكولات الإدارة الموحدة، مما يجعل تشخيص وعلاج RCC صعبين بسبب الحاجة إلى تحقيق التوازن بين نتائج اورام الأمومة وسلامة الجنين. استخدام وسائل التصوير مقيد بسبب القيود المتعلقة بالحمل، والجراحة تحمل خطر الولادة المبكرة. وقد حسن النهج متعدد التخصصات وتقنية طفيفة التوغل النتائج. أبلغ عن امرأة عمرها 25 عاما ولديها 23 أسبوعا من الحمل مع ألم في الجانب الأيسر ووجود دم في البول. أظهر التصوير بالموجات فوق الصوتية كتلة صلبة في الكلى اليسرى بحجم 4.5 × 4 سم، والتي تم تعريفها لاحقا باستخدام الرنين المغناطيسي غير التباين على أنها مشبوهة في RCC. في الأسبوع السادس والعشرين، تم إجراء استئصال الكلى الجذري الأيسر باستخدام نهج خلف الصفاق تحت التخدير فوق الجافية مع إشراف دقيق أثناء العملية مع استعداد للتوليد بعد استشارة متعددة التخصصات وموافقة من المريضة. سارت الجراحة بسلاسة مع فقدان دم أثناء العملية بمقدار 400 مل وقياسات مستقرة بين الأم والجنين. **التشخيص**: أظهرت النسيجية وجود RCC واضح للخلايا، pT1bN0Mx، درجة WHO/ISUP 2، مع هوامش حرة. بعد تعافي هادئ، أنجبت المريضة طفلة سليمة عن طريق الولادة القيصرية في الأسبوع الثامن والثلاثين. يجب النظر في RCC لدى النساء الحوامل اللاتي يبلغن عن أعراض بولية مستمرة، أو دم في البول، أو ألم في الجانبين، أو كتل. لا يزال التصوير بالموجات فوق الصوتية هو الوسيلة التشخيصية الرئيسية، كما يوفر الرنين المغناطيسي توصيفا أفضل للأنسجة دون التعرض للإشعاع. عملية اتخاذ القرار متعددة التخصصات فريدة تأخذ في الاعتبار بيولوجيا الورم، حجمه، عمر الحمل، وتفضيلات المريض ستعظم النتائج الأورامية والتوليدية على حد سواء.

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INTRODUCTION

Renal cell carcinoma (RCC) comprises 3 percent of all malignancies of adults and is the third most prevalent urological neoplasm globally. RCC affects one in each one thousand pregnancies [1]. However, its overlap with pregnancy is extensively under researched, and the physiological changes that accompany pregnancy conceal RCC pathology. The intersection of the urgency of oncology and the constraint of obstetrics imposes a diagnostic dilemma, compounded by restrictions on imaging modalities such as computed tomography due to radiation risks, leaving ultrasound and magnetic resonance imaging as safer but sometimes less definitive alternatives. The result is a diagnostic paradigm that often leads to incidental or late diagnosis [2]. The known risk factors for RCC include obesity, smoking, high blood pressure, diabetes, and hereditary syndromes [3]. There are less definite indications of whether or not pregnancy itself is a risk modulator. The extreme upsurge of estrogen and progesterone has raised the speculation of hormonal carcinogenesis, as it has been supported by experimental models in rodents [4,5]. Infrequent familial examples associated with Xp11.2 translocations or von Hippel-

Lindau mutations suggest that genetic susceptibility may be exposed by hormonal conditions during pregnancy [6]. It is still not known how gestation affects renal oncogenesis at the molecular level. The gynecologist is central in early recognition, ensuring that fetal well-being is prioritized while facilitating appropriate urological interventions. The rarity of such cases, combined with the absence of standardized guidelines, underscores the importance of a multidisciplinary approach. Here, we provide a case of a renal mass in pregnancy with a gynecological approach, with a focus on diagnostic reasoning and imaging strategy and decision-making in treatment over a specialized literature review.

Case Presentation

A 25-year-old primigravida at 23 weeks of gestation presented with intermittent left flank pain and mild hematuria. Her antenatal course was uneventful. Ultrasound (US) revealed a solid hypoechoic renal mass measuring 4.5 × 4.0 cm involving the interpolar region of the left kidney with internal vascularity in Doppler ultrasound. Non-contrast magnetic resonance imaging (MRI) confirmed a well-circumscribed lesion with intermediate T1 signal intensity and relatively T2 hypointensity, suspicious for renal cell carcinoma; there was no locorenal lymphadenopathy, and the left renal vein looked normal (Figure 1).

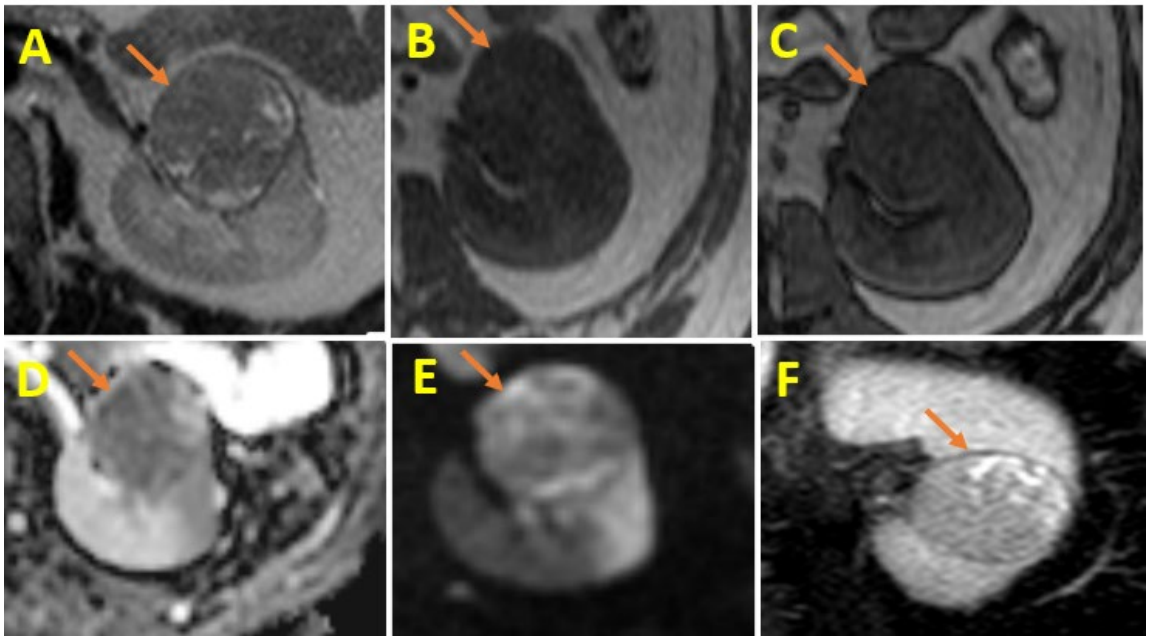

Figure 1: Selected sections of non-contrast MRI of the upper abdomen (A) axial T2WI, (B)axial T1WI, (C) T1WI with fat saturation, (D) DWI, (E) ADC map,(F) coronal T2 STIR: show well-defined solid mass involving /exophytic from the anterior aspect of the interpolar region of the left kidney (orange arrows), iso intense in T1WI, not suppressed in fat sat sequence, heterogenous iso/hypo intense SI in T2WI, restricted in DWI and ADC map.

After multidisciplinary discussion, involving a urologist, obstetrician, anesthesiologist, and neonatologist, the surgical intervention was warranted given the tumor size, presentation, and patient preference, who declined expectant management until postpartum. A left radical nephrectomy via a retroperitoneal approach was performed at 26 weeks of gestation under regional epidural anesthesia. Grossly, the tumor was a circumscribed solid mass measuring 4.5 × 4.0 cm in its greatest dimensions with a typical golden yellow color. Histopathology confirmed clear cell renal carcinoma, stage T1b, with negative margins. RCC, WHO/ISUP grade 2, with negative margins and no lympho-vascular invasion (pT1bN0Mx) (Figure 2A-D). Besides the urologist, the gynecologist's role during surgery was pivotal—providing intraoperative fetal monitoring and ensuring uterine relaxation with nifedipine. Left lateral uterine placement was maintained throughout the surgery, and the patient was prepared for emergency obstetric intervention if required. The estimated blood loss was about 400 cc over 180 minutes, and both the mother and the baby stayed stable during the whole procedure.

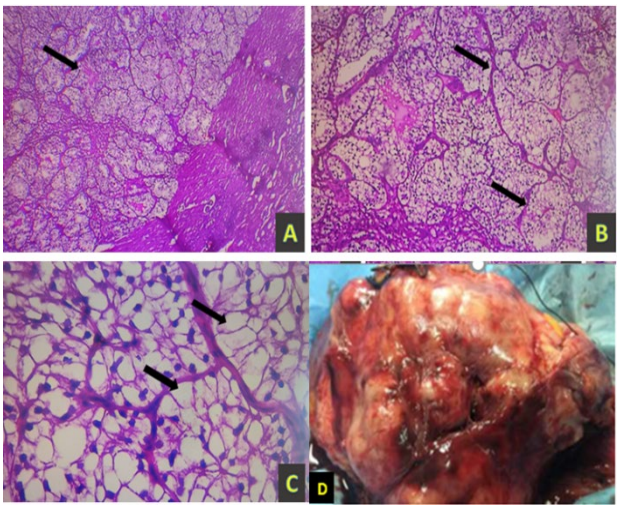

Figure 2: Histopathologic features of clear cell renal cell carcinoma (H&E stain). (**A**) Low power (X10) shows renal cortical tissue on the right side of the image, and clear cell carcinoma on the left side (arrow); (**B**) Medium power (X20) show nests of malignant cells with clear cytoplasm separated by thin fibrous septae (arrow); (**C**) High power (X40) show tumor cells with clear cytoplasm (arrow) and hyperchromatic nuclei; and (**D**) A gross appearance of the renal mass.

The pregnancy progressed without further complication, and she delivered a healthy female infant via cesarean section at 38 weeks, weighing 3,100 grams with an Apgar score of 9/10. From our experience, this is the second case of a renal tumor with pregnancy [4]. As the first case was managed with active surveillance and then radical nephrectomy four weeks after cesarean section, this case was managed actively during the pregnancy, as the patient and her family asked for surgery to obtain rid of the risk of malignancy, which underscores how individualized management is driven when evidence-based protocols are lacking. 2 years after the surgery, the case is stable with no recurrence, and she is on regular follow-up visits.

Ethical considerations

The study protocol was approved by the Research Ethics Committee of the College of Medicine, Mustansiriyah University (IRB 290; dated 17/2/2024). The patient gave written informed consent for publication of this case report and any accompanying images.

DISCUSSION

While renal cell carcinoma accounts for most renal masses in pregnancy, RCC is extremely uncommon, and our case adds to this small body of knowledge. We have summarized published cases in the last decade to enable comparison of diagnostic strategies, therapeutic strategies, and outcomes (Table 1). The absence of RCC symptomatology during pregnancy is typical.

Table 1: Summary of RCC cases reported in pregnancy during the last decade with respect to patient demographics and clinical picture, diagnostic and therapeutic modalities used as well as fetomaternal outcome

Author(s)	Age (year)	Presenting symptom(s)	Diagnostic modality	Management Strategy	Feto-Maternal Outcome
Ferreira *et al*. (2025) [7]	37	six weeks of gestation with left-sided flank pain and pollakiuria.	Ultrasound and MRI	Laparoscopic radical nephrectomy at 14 weeks of gestation	Healthy vaginal birth progression; small for gestational age fetus
Wang *et al*. (2024) [6]	28	Hematuria for 1 day at 29 weeks of gestation	CT scan FISH and genetic testing	Radical surgery was performed post-delivery at 29 weeks	Successful delivery and surgery; no fetal harm
Tsutsui *et al*. (2023) [8]	36	Incidentally 5 weeks pregnant	Ultrasound and enhanced CT	Robot-assisted partial nephrectomy; timing at 15 weeks of pregnancy	Healthy vaginal birth; no maternal complications
Dey *et al*. (2022) [9]	34	Persistent dyspepsia in 2nd trimester Dual tumor growth in 3rd trimester	CT, MRI, and endoscopy	Elective cesarean at 34 weeks followed by tumor excision	Survival of both mother and child ensured
Farhan & Ridha (2022) [10]	20	Hypertension; Hematuria and a large tumor for 20 weeks	Ultrasound and MRI	Multidisciplinary decision on 34 weeks C section followed by left radical nephrectomy 4 weeks after C section	Focused on fetal safety and maternal wishes
Zakieldahshoury *et al*. (2022) [11]	20	Hypertension; Spontaneous tumor rupture; acute pain and retroperitoneal collection post C- section	Ultrasound (delayed detection) and CT scan	Urgent, life-saving radical nephrectomy	Mother was saved
Dong *et al*. (2020) [12]	36	21st week of pregnancy T2 RCC lesion	Ultrasound and MRI	Retroperitoneal laparoscopic partial nephrectomy at 21 weeks	Full-term delivery; good health for mother and infant
Ozozan & Isgoren (2020) [13]	36	at 12th with right flank and loin pain	Ultrasound, MRI for tumor characterization	Open partial nephrectomy with zero ischemia time at 14 weeks	Uneventful recovery; confirmed fetal survival
Koetter & Martin (2020) [14]	16	Indecently discovered at 24 week US	Ultrasound MRI	6 Week postpartum nephrectomy	Healthy infant delivery; delayed surgery
Ayati *et al*. (2019) [15]	27	Large mass in left kidney and Tumor thrombus	Ultrasound, MRI, CT, and TEE	Simultaneous cesarean and radical nephrectomy with IVC thrombectomy	Uneventful postoperative course; healthy delivery
Ghanney *et al*. (2017) [16]	37	Mass was discovered at 24 weeks and urgently presented as IVC tumor thrombus	Ultrasound, MRI, CT, and TEE	Preterm cesarean at 30 weeks followed by radical nephrectomy and IVC thrombectomy.	Successful maternal surgery after preterm delivery

Back pain, abdominal cramps, and pelvic pressure are considered gestational physiology, making a majority of cases incidental findings of the routine antenatal ultrasonography. As symptoms present gross hematuria or palpable flank mass, they bypass the issue of diagnostic ambiguity [17]. There is a presentation spectrum that goes from asymptomatic all the way up to catastrophic presentation. RCC may present itself as a hypertensive disorder, thus postponing the appropriate investigations. Wunderlich syndrome—where spontaneous tumor rupture occurs as a retroperitoneal hemorrhage and maternal salvage is achieved by immediate nephrectomy [18,19]. At the extreme, the presence of a tumor thrombus in the inferior vena cava that penetrates into the right atria requires multidisciplinary surgery that involves cardiopulmonary bypass [16]. There have been reports of rapid RCC tumor growth in the third trimester, which underscores the hormonal regulation of tumor biology; however, the exact mechanism is still unclear [9]. The first modality in RCC diagnosis is ultrasonography, which capitalizes on the safety and access in the daily obstetric practice [20]. It identifies solid renal masses larger than 3 cm and evaluates hydronephrosis but lacks good tissue characterization and reproducible stage determination [21]. Magnetic resonance imaging has become the definitive modality of choice. Non-contrast sequences eliminate the use of gadolinium but offer better soft-tissue resolution, the ability to distinguish between benign and

malignant lesions, evaluation of the presence of venous involvement, visualization of tumor thrombus, and potentially evaluation of the presence of retroperitoneal lymphadenopathy without the use of ionizing radiation [16]. Computerized tomography is still used in special cases, even when it offers better anatomical detail, such as emergency presentation with suspected hemorrhage, where the vascularity is complex and needs granular surgical planning, or when the patient is not MRI-safe. Every decision will require a clear analysis of risks and benefits, weighing the exposure of the fetus to radiation versus maternal diagnostic and treatment necessity [22,23]. Clear cell RCC is grossly characterized by lipid-rich cytoplasm, because of the golden-yellow color of cut surfaces, and is microscopically characterized by cells having large volumes of clear cytoplasm, fragile vascular networks, and normal alveolar structure [24]. The RCC subtype exhibits aggressive biological behavior. Variant histologists (chromophobe RCC and the eosin variant) are less common but must be identified because of their different prognostic implications. Xp11.2 translocation RCC is a rare issue, but it is worth considering in younger patients because the conventional immunohistochemistry test is inconclusive. Fluorescence in situ hybridization or molecular genetic testing is a definite diagnosis [6,3]. The RCC symptoms resembling normal gestation physiology are often confused with benign conditions, and therefore, there is a need to be very vigilant to discriminate RCC. Other differential diagnoses, including benign renal lesions, such as hemorrhagic cysts (especially those of von Hippel-Lindau disease), angiomyolipoma, and oncocytoma, need an imaging modality for further differentiation. Acute emergencies that accompany spontaneous tumor rupture (Wunderlich syndrome) should be differentiated from placental abruption or uterine rupture. Lastly, infrequent synchronous malignancies have been reported [25,26]. RCC in pregnancy has to be managed in an individualized manner with acceptance of maternal oncological control versus fetal safety. From a gynecologist's perspective, coordination of care is essential—ensuring continuous fetal monitoring during urological surgery, preparing for perioperative complications such as preterm labor, and providing emotional support. Gynecologists also play a central role in postoperative surveillance of fetal growth and maternal recovery. Anticipating anesthetic risks, preterm labor, and potential maternal morbidity is crucial. The gynecologist should also address fertility preservation and counseling regarding future pregnancies. The gynecologist's role, therefore, extends beyond routine obstetric care to encompass advocacy for safe diagnostics, intraoperative fetal protection, and multidisciplinary collaboration. The only curative therapeutic method is surgery. Local tumors that may be amenable to nephron-sparing resection are finding greater popularity with partial nephrectomy, as the procedure preserves renal function, which is especially valuable in young women of reproductive age. Radical nephrectomy is used in larger tumors, multifocal disease, or unfavorable anatomy. Robot-assisted and laparoscopic surgery have lower morbidity, blood loss, and a faster recovery than the open method [27]. A complex presentation of IVC tumor thrombus would require radical nephrectomy and thrombectomy, sometimes necessitating use of cardiopulmonary bypass and cardiac surgical involvement [16]. First-trimester intervention is used in aggressive tumors even if there is a risk of miscarriage. The second trimester is the best surgical period, as it is the period between the completion of organogenesis and the sufficient gestation period allowed by the fetus to tolerate anesthesia. Depending on the kinetics of tumor growth and maternal stability, the management of the third trimester can be either delayed until fetal viability (≥28 weeks) or delayed until postpartum. In case of late gestation diagnosis, cesarean delivery and nephrectomy can be conducted simultaneously when the patient requires urgent attention [14]. In pregnancy, immunotherapy has not been well investigated. There are isolated case reports of ipilimumab and nivolumab in metastatic disease, but there are not adequate data on their safety to provide evidence-based advice. Teratogenic risks are known by targeted therapies, which are contraindicated [28]. The stage of the diagnosis and the timing of the intervention determine the RCC prognosis. Prompt nephrectomy for early-stage illness leads to favorable outcomes with minimal recurrence. Even with aggressive management, advanced presentations such as tumor rupture, IVC thrombus, and metastatic disease have uncertain outcomes. When resection is accomplished, stage-dependent survival for the mother is similar to non-pregnant cases. Reports on isolated immunotherapy in metastatic disease are promising, but they are not broadly applicable [29]. The majority of pregnancies end in live births, a favorable fetal outcome. While second-trimester intervention creates a balance between safety and fetal maturity, first-trimester surgery carries a risk of miscarriage. Maternal morbidity and operating time are decreased by less invasive procedures. In circumstances of late gestation, concurrent cesarean delivery and nephrectomy are feasible [6]. The pregnancy's impact on tumor biology, recurrence patterns, and long-term mother survival is still unknown. There are no data on the neurodevelopment of offspring after maternal therapy [20]. We have summarized RCC management for pregnancy in Figure 3.

Conclusion

Renal masses in pregnancy, though rare, demand careful multidisciplinary management. Gynecologists play a pivotal role not only in guiding diagnosis and counseling but also in real-time intraoperative fetal monitoring and perioperative support. Their presence in the operating room ensures fetal safety while the urologist focuses on maternal surgical care. Early recognition, collaborative planning, and adherence to evidence-based practices can optimize outcomes for both mother and child.

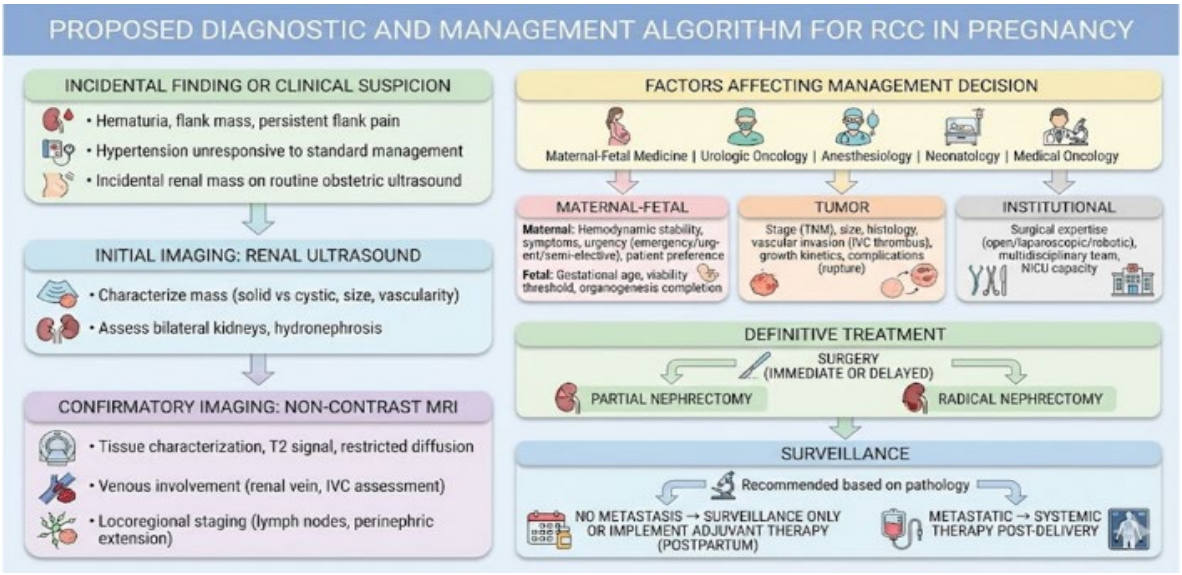

Figure 3: Suggested flow chart for managing RCC in pregnancy, including confirmation of the case, factors that guide treatment, and definitive treatment approach.

Conflict of interests

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Data sharing statement

N/A

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