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# Comparison Between the Role of Transabdominal Ultrasound Versus Transvaginal Ultrasound in the Evaluation of Placental Invasion in Cases of Placenta Previa Anterior Wall With a Previous Uterine Scar

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## Abstract

**Background:** Transabdominal ultrasound and transvaginal ultrasound are complementary for diagnosis; also, in situations of placenta previa, transvaginal ultrasonography is safe and enables thorough inspection of the lower uterine section.

**Aim and objectives:** The study's objective was to compare how placental invasion was assessed using transabdominal ultrasound versus transvaginal ultrasound in patients with placenta previa anterior wall with a prior uterine scar.

**Subjects and methods:** Between April 2021 and September 2021, 120 pregnant women with chronic placenta previa (beyond 28 weeks of pregnancy) were prospectively included in this research at the Department of Gynecology and Obstetrics, AL Azhar University Hospital.

**Results:** Of the 94 positive clear zone TVS, 70 patients showed a positive clear zone by TAS. TVS accuracy was 63.3% and TAS was 78.3% in detecting retroplacental clear zone.

**Conclusion:** Based on our findings, transabdominal ultrasound and transvaginal ultrasound are complementary for diagnosis; also, in situations of placenta previa, transvaginal ultrasonography is safe and enables thorough inspection of the lower uterine section.

**Keywords:** Accuracy, Placenta previa, Transabdominal, Transvaginal, Ultrasound

## 1. Introduction

Placental attachment disorder (PAD), also referred to as morbidly adherent placenta (MAP) or its most recent acronym abnormally invasive placenta (AIP), is a spectrum of diseases marked by irregular adherence of the placenta to the myometrium. According to the extent of trophoblastic invasion into the myometrium and uterine serosa, there are three different kinds of placentas: accreta, increta, and percreta.<sup>1</sup>

When compared with posterior placentation, the placenta previa anterior wall is linked with a much

higher incidence of problems, including bleeding and the need for a hysterectomy.<sup>2</sup>

Despite the advancements in imaging technology, no definitive diagnostic method provides 100% certainty on the absence or presence of placenta accrete.<sup>3</sup>

Antenatal identification of MAP and multidisciplinary team approaches have the potential of reducing maternal and prenatal intrapartum difficulties, which includes less maternal blood loss, with fewer transfusion requirements, decreasing the rate of hysterectomy, intraoperative urologic and gastrointestinal injuries, and maternal deaths.<sup>4</sup>

With the rising of CS rate, there was a higher rate of abnormal placentation, in subsequent pregnancies, leading to clinical complications of placenta previa and placenta accreta. The prevalence of maternal mortality and morbidity has increased due to all of these circumstances.<sup>5</sup>

Transvaginal ultrasound is the safest method in cases of placenta previa has been confirmed, and it has been found that transvaginal ultrasonography is superior to transabdominal sonography in the detection of placenta previa.<sup>6</sup>

Transvaginal ultrasound is safe in situations of placenta previa and enables thorough evaluation of the lower uterine section. Transabdominal ultrasound and transvaginal ultrasound are complementary for diagnosis. To increase the comparability of future investigations, the European Working Group on abnormally invasive placenta (EW-AIP) sought to advance diagnosis and therapy as well as encourage research and information on AIP.<sup>7</sup>

<AQ: Pls check whether text missing here > to contrast the functions of transvaginal ultrasonography and transabdominal ultrasound in assessing placental invasion in instances with placenta previa anterior wall with a history of uterine scarring.

## 2. Patients and methods

Between April 2021 and September 2021, 120 pregnant women with persisting placenta previa (beyond 28 weeks' pregnancy) were prospectively included in this research at the Department of Gynecology and Obstetrics, AL Azhar University Hospital.

**Inclusion criteria:** Women who are of childbearing age range (18–45), who were identified with persisting placenta previa anterior wall after 28 weeks of pregnancy, and who had undergone a Caesarean section or another type of uterine surgery in the past were all admitted to the Department of Gynecology and Obstetrics at the hospital affiliated with AL Azhar University.

**Exclusion criteria** are Unscarred uterus and placenta previa with a posterior wall.

Each patient in this study was subjected to the following:

Taking a complete history, including personal history (name, age, file number), obstetric history (how many CS., abortions, placenta previa there were in the previous pregnancy, history of ectopic, medical disorder with pregnancy, and the number of living children), present history (complaints, gestational age, medical disorder in the present pregnancy, and history of antepartum hemorrhage), and past history (postpartum sepsis, postpartum

hemorrhage, and chronic diseases). Informed consent was obtained before scanning.

Intraoperative data including uterotonic administration, placental site, spontaneous rupture, placental invasion of the bladder and nearby organs, damage to the bladder, ureters, or intestines, blood loss, and blood transfusions, conservative management to avoid hysterectomy, and need for Intensive Care Unit admission were obtained.

Postoperative data included postoperative hemoglobin level and other labs, postoperative blood transfusion, and need for Intensive Care Unit admission.

Histopathological examination in cases of hysterectomy:

Two experienced operators performed thorough imaging utilizing all diagnostic modalities (color Doppler and grayscale) both transabdominally and transvaginally, followed by offline analysis of the captured pictures and volumes.

A 2D ultrasound equipment with a 4–8 MHz transabdominal transmitter and a 12 MHz transvaginal transmitter was used to conduct the ultrasound evaluation.

The transabdominal ultrasound was carried out by operators with different levels of competence than the transvaginal one, and both were blinded to the findings of the other's examination.

With the bladder around 300 ml filled, the placenta was inspected for proper visibility and placement.

When the examined placenta exhibits one or more of the unified descriptors listed below, as defined by the EW-AIP, the placenta is suspected of having an aberrant invasion:

To prevent selection bias, the angle of insonation will be kept as low as possible. The resistance index of flow within unusual lacunae and any newly established vessels over the serosa-bladder border will be evaluated in at least three different locations. The lowest value will be used for analysis. The serosa-bladder interface could be seen clearly as there was enough bladder capacity while imaging the placenta.

A 2D power Doppler examination specifically targeting the lower uterine segment and the placenta was performed, and the views were successively assessed to analyze the angioarchitecture of this region. The serosa–bladder interface was visible in the basal view, which rotated the lateral view by 90°. The lateral view was used to examine the intraplacental vasculature and the serosa–bladder complex along the sagittal axis of the mother's pelvis (from the perspective of the bladder).

All of the pregnancies included in this research were born through a cesarean section at the hospital

affiliated with the AL Azhar University, and detailed information on the birth was available.

### 2.1. Statistical analysis

Utilizing SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) and MedCalc 13 for Windows, all data were gathered, tabulated, and statistically evaluated (MedCalc Software bvba, Ostend, Belgium). Using the Shapiro–Walk test, the distribution of the data was examined for normality. To represent qualitative data, frequencies and relative proportions were used. The chi-square test ( $\chi^2$ ) and Fisher's exact were used to determine the variation between the qualitative variables, as illustrated. Quantitative information was presented as mean  $\pm$  SD (standard deviation).

## 3. Results

**Table 1.**

Table 1. Demographic characteristics of the studied patients.

	Patients (n = 120)
<b>Age (years)</b>	
Median $\pm$ SD	36.31 $\pm$ 8.44
Ranging	21–44
<b>BMI (kg/m<sup>2</sup>)</b>	
Median $\pm$ SD	26.84 $\pm$ 3.65
Ranging	22–32
<b>No. of previous CS</b>	
Median $\pm$ SD	2.92 $\pm$ 0.845
Ranging	2–4

Patients ranged in age from 21 to 44 years with an average age of  $36.31 \pm 8.44$  years and a median BMI of  $26.84 \pm 3.65$  kg/m<sup>2</sup>. Previous CS numbers varied from 2 to 4.

This table shows that patients' median gravidity was  $4.08 \pm 1.46$  and their median parity was  $3.16 \pm 1.204$ . (Fig. 1), Table 2.

Of the 94 positive clear zone TVS, 70 patients showed a positive clear zone by TAS. The TVS accuracy was 63.3% and TAS was 78.3% in detecting retroplacental clear zone Tables 3 and 4.

Of the 102 abnormal lacuna TVS, 94 patients had abnormal lacuna TAS. TVS accuracy was 80% and TAS was 85% in detecting abnormal lacuna Tables 5 and 6.

Of the 109 uterovesical hypervascularity TVS, 99 patients were uterovesical hypervascularity TAS.

Table 2. Comparison of the retroplacental clear zone between TAS and TVS.

Clear zone TAS	Clear zone TVS		Total	P
	Positive	Negative		
<b>Positive</b>				
Count	70	6	76	
% within TAS	92.1%	7.9%	100%	
% within TVS	74.5%	23.1%	63.3%	
<b>Negative</b>				
Count	24	20	44	
% within TAS	54.5%	45.5%	100%	<0.001
% within TVS	25.5%	76.9%	36.7%	
<b>Total</b>				
Count	94	26	120 (100%)	
% within TAS	78.3%	21.7%		
% within TVS	100%	100%		

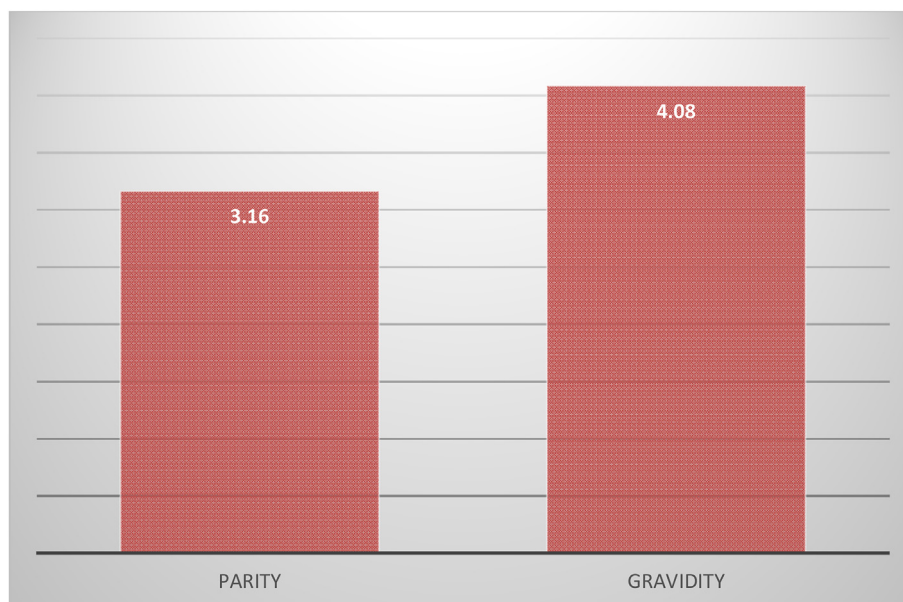


Fig. 1. Parity and gravidity distributions among the patients.

Table 3. Diagnostic value.

Statistic	Value	95% CI
Sensitivity	74.47%	64.43–82.91%
Specificity	76.92%	56.35–91.03%
Positive Predictive Value (PPV)	92.11%	85.13–95.96%
Negative Predictive Value (NPV)	45.45%	35.74–55.53%
Accuracy	75%	66.27–82.45%

Table 4. Comparison of abnormal placental lacuna between TAS and TVS.

Lacuna TAS	Lacuna TVS		Total	P
	Abnormal	Normal		
<b>Abnormal</b>				
Count	94	2	96	
% within TAS	97.9%	2.1%	100%	
% within TVS	92.2%	11.1%	80%	
<b>Normal</b>				
Count	8	16	24	
% within TAS	33.3%	66.7%	100%	<0.001
% within TVS	7.8%	88.9%	20%	
<b>Total</b>				
Count	102	18	120 (100%)	
% within TAS	85%	15%		
% within TVS	100%	100%		

Table 5. Diagnostic statistic.

Statistic	Value	95% CI
Sensitivity	92.16%	85.13–96.55%
Specificity	88.89%	65.29–98.62%
Positive Predictive Value (PPV)	97.92%	92.71–99.43%
Negative Predictive Value (NPV)	66.67%	50.20–79.87%
Accuracy	91.67%	85.21–95.93%

Thus, TVS accuracy was 84% and TAS was 91% in detecting uterovesical hypervascularity Table 7.

Of the 92 positive bridging vessel TVS, 80 patients were positive bridging vessels. Thus, the TVS

Table 6. Comparison of Uterovesical vascularity between TAS and TVS.

TAS	TVS		Total	P
	Positive	Negative		
<b>Positive</b>				
Count	99	2	101	
% within TAS	98%	2%	100%	
% within TVS	90.8%	18.2%	84.2%	
<b>Negative</b>				
Count	10	9	19	
% within TAS	52.6%	47.4%	100%	<0.001
% within TVS	9.2%	81.8%	15.8%	
<b>Total</b>				
Count	109	11	120 (100%)	
% within TAS	90.8%	9.2%		
% within TVS	100%	100%		

Table 7. Comparison of Bridging vessels between TAS and TVS.

Bridging vessels TAS	Bridging vessels TVS		Total	P
	Positive	Negative		
<b>Positive</b>				
Count	80	7	87	
% within TAS	92%	8%	100%	
% within TVS	87%	25%	72.5%	
<b>Negative</b>				
Count	12	21	33	
% within TAS	36.4%	63.6%	100%	<0.001
% within TVS	13%	75%	27.5%	
<b>Total</b>				
Count	92	28	120 (100%)	
% within TAS	76.7%	23.3%		
% within TVS	100%	100%		

accuracy was 72.5% and the TAS was 76.7% in detecting bridging vessels.

#### 4. Discussion

The frequency of morbidly adherent placenta (MAP), which is often linked to excessive bleeding, bladder injuries, and hysterectomies, has considerably grown during the last 50 years.<sup>8</sup>

Maternal mortality from placenta accrete is estimated to be 6–7% regardless of the type of operation.<sup>9</sup>

Despite recent improvements in imaging methods, no one diagnostic method provides 100% certainty about the presence or absence of placenta accretes.<sup>3</sup>

It has been determined that transvaginal ultrasonography is superior to transabdominal sonography in the detection of placenta previa, and that transvaginal ultrasound is safe to use in instances of placenta previa.<sup>6</sup>

In instances with placenta previa anterior wall with a prior uterine scar, this investigation compares the effectiveness of transabdominal ultrasonography to transvaginal ultrasound in assessing placental invasion.

This is a prospective cohort research that was done on 120 pregnant ladies not in labor, who were indicated for termination of pregnancy at the Department of Gynecology and Obstetrics, AL-Azhar University Hospitals, during the period from April 2021 till the end of the study. And The study has been approved by the ethics committee.

Full history was taken. Clinical Examination, laboratory investigations, radiological investigations of the studied patients, and statistical analysis of data have been done.

In our study regarding demographic characteristics of the studied patients, the mean age was



33.54 ± 4.13 years, which ranged from 21 to 44 years. The mean BMI was 26.84 ± 3.65 kg/m<sup>2</sup>, which ranged from 22 to 32 kg/m<sup>2</sup>. The numbers of prior CS were ranging from 2 to 4. Patients' median gravidity was 4.08 ± 1.46, and their median parity was 3.16 ± 1.204.

In agreement with our results, the study by *Tovbin et al.*<sup>10</sup> noted that throughout the trial, 268 patients were enrolled overall. A diagnosis of MAP was given to 23 women (8.9%), although there was no clinical evidence of an adhered placenta in 235 (91.1%) of the women. The median gestation age at assessment was 33.9 weeks (range, 16–41), and the mean ± SD mother age was 33.8 ± 4.5 years. Maternal gravidity and parity had a mean ± SD values of 4.0 ± 1.6 and 2.0 ± 1.2, respectively. At delivery, the average gestational age was 37.7 ± 1.7 weeks (between 24 and 41).

In addition, *Farkhunda et al.*<sup>11</sup> observed that the majority of patients belonged to the age category of 25–30 years in the prior case–control research that was designed to detect the risk factors for placenta previa. In comparison to 251 patients (7.67%), 21 patients (26.92%) had previously had a cesarean delivery (*p* value = 0.001). Eleven patients (1.41%) had a parity of 0–1, while 33.12% of the control group did < AQ: Pls check whether text missing here>. Thirty-eight patients (48.71%) had a parity of 2–5 compared with 1193 (50.33%) in the control group. When compared with the control group, the prevalence of placenta previa was also considerably higher in grand multiparous women; 29 patients (37.17%) had a parity of 5 as opposed to 392 individuals (16.54%) (*p*-value = 0.01).

Also, another study by *Hamada et al.*<sup>12</sup> sought to determine if instances of placenta previa are more likely than those without having placenta lacunae and a clean zone. In all, 2413 moms delivered living singletons throughout the research period. There were 2343 instances with normal placentas compared with 70 cases (2.9%) with placenta previa. A case–control research comparing 350 instances with normal placentas to the 70 cases of placenta previa was carried out. Thirteen instances (18.6%) of placenta previas were found on the anterior wall, while 57 cases (81.4%) were found on the posterior wall. The other ladies were multiparous and had given birth vaginally. Patients with placenta previa had considerably higher parity and a higher number of prior cesarean procedures. The weeks of gestation at delivery, newborn birth weight, and Apgar score were all substantially lower in the placenta previa group.

In a previous study by *Gouhar et al.*,<sup>13</sup> in this research, 119 individuals with a mean age of 27 ± 4.6

years and a median gestation age of 36.0 ± 5.5 weeks were involved. In accordance with the results of the birth, 103 patients had placenta previa (61 patients had partial placenta previa and 41 patients had total placenta previa), whereas the remaining 16 patients did not. Based on the results of the deliveries of 39 of the 103 patients who tested positive for PP, 12 of the 39 patients had a history of cesarean sections, nine had a history of dilatation and curettage, and 18 had a history of both procedures.

Regarding the clinical data of the studied patients in the current study, the mean SBP was 132.72 ± 12.44 mm Hg, the mean DBP 79.13 ± 8.55 mm Hg, the mean Hb 10.83 ± 2.44 g/dl, the mean TLC 11.15 ± 3.45 × 10<sup>3</sup>/l, the mean PLT 345.54 ± 57.76 × 10<sup>3</sup>/l, the mean ALT 52.22 ± 26.34 U/l, the mean AST 46.37 ± 23.76 U/l, and the mean INR was 1.14 ± 1.01.

In recent research, the purpose was to examine the placental invasion in women with placenta previa and a prior uterine scar using transvaginal 3D ultrasound vs transabdominal 2D ultrasound. According to *Hammouda et al.*,<sup>14</sup> the hematocrit value was considerably lower post-op than pre-op values (27.16 ± 2.51 vs. 30.92 ± 2.78, respectively, *P* = 0.024).

Another study by *Tairy et al.*<sup>15</sup> comprised 211 instances of placenta previa; infants in the anterior PP group were more likely to have 5 min ventilation than those in the posterior PP group. Lower birth hemoglobin, 15.8 vs. 16.7, *P* = 0.03; greater risk of blood transfusion, 13.4 vs. 2.9%, *P* = 0.007; Apgar score <7, 6% vs. 0%, *P* = 0.02, and comparable unfavorable neonatal outcomes were seen in each group.

In this study according to the comparison of retroplacental clear zone between TAS and TVS, of the 94 positive clear zone TVS, 70 patients showed positive clear zone by TAS. TVS accuracy was 63.3% and TAS was 78.3% in detecting retroplacental clear zone. The results were statistically highly significant (*P* < 0.001). Diagnostic statistic value sensitivity = 74.47% (95% CI, 64.43%–82.91%), specificity = 76.92% (95% CI, 56.35%–91.03%), PPV = 92.11% (95% CI, 85.13%–95.96%), NPV = 45.45% (95% CI, 35.74%–55.53%), and accuracy = 75% (95% CI, 66.27%–82.45%).

For the detection of retroplacental clear zone *Hammouda et al.*<sup>14</sup> noted that the sensitivity of 2D transvaginal ultrasound was 75%, while the sensitivity of 3D transabdominal ultrasound was 53.3%.

A previous study conducted by *Cali et al.*<sup>16</sup> noted that loss of the retroplacental clear zone was associated with 90% sensitivity, 81% specificity, 57% PPV, and 97% NPV.

Bhide *et al.*<sup>17</sup> noted that 37 (65%) women who did not have placenta accreta and all of the women who did had a lack of clear space. It is hence sensitive but not particular. Because it has a significant NPV, the clear space's main purpose seems to be to efficiently exclude placenta accrete when it is present.

However, Romeo *et al.*<sup>18</sup> noted that the bulk of false-positive findings are caused by the disappearance of the retroplacental clear zone; hence, the criteria should not be utilized to determine the diagnosis alone.

The current results show the comparison of abnormal placental lacuna between TAS and TVS; of the 102 abnormal lacuna TVS, 94 patients had abnormal lacuna TAS. TVS accuracy was 80% and TAS was 85% in detecting abnormal lacuna. The results were statistically highly significant ( $P < 0.001$ ). Regarding the diagnostic statistical value sensitivity = 92.16% (95% CI, 85.13–96.55%), specificity = 88.89% (95% CI, 65.29–98.62%), PPV = 97.92% (95% CI, 92.71–99.43%), NPV = 66.67% (95% CI, 50.20–79.87%), and accuracy = 91.67% (95% CI, 85.21–95.93%).

Maged *et al.*<sup>19</sup> noted that atypical lacunae were seen, with a sensitivity of 93%, PPV of 80.82%, NPV of 85.19%, and an accuracy of 82.00%.

Pilloni *et al.*<sup>20</sup> noted that aberrant lacunae with a specificity of 94.6% and a sensitivity of 48.6%.

However, Cali *et al.*<sup>16</sup> noted that sensitivity and specificity for aberrant lacunae was 73.0% and 86.7%, respectively.

D'Antonio *et al.*<sup>21</sup> noted that among other criteria of US results, aberrant placental lacunae have the best accuracy with the highest sensitivity and specificity.

According to the comparison of myometrial thinning between TAS and TVS, of the 91 positive myometrial thinning TVS, 58 patients were of positive myometrial thinning TAS. TVS accuracy was 54.2% and TAS was 75.8% in detecting myometrial thinning; the results were statistically highly significant ( $P < 0.001$ ).

Recent research by Hammouda *et al.*<sup>14</sup> noted that for the detection of myometrial thinning, the sensitivity of 3D transabdominal ultrasound was 65.0% and the 2D transvaginal ultrasound sensitivity was 71.6%.

Although various authors have studied myometrial thickness  $<1$  mm, their use is complicated by the fact that the lower uterine segment's myometrium naturally thins as term approaches, but Wong *et al.*<sup>22</sup> discovered a sensitivity of 22%, specificity of 100%, PPV of 100%, and NPV of 89% (nine women).

The comparison of uterovesical vascularity between TAS and TVS showed that of the 109

uterovesical hypervascularity TVS, 99 patients were of uterovesical hypervascularity TAS. Thus, TVS accuracy was 84% and TAS was 91% in detecting uterovesical hypervascularity. The results were statistically highly significant ( $P < 0.001$ ).

In recent research by Hammouda *et al.*<sup>14</sup> for the detection of uterovesical vascularity, the sensitivity of 3D transabdominal ultrasound was 88.3% and the 2D transvaginal ultrasound sensitivity was 83.3%.

According to a recent comprehensive analysis by D'Antonio *et al.*<sup>21</sup> the overall pooled sensitivity and specificity from 12 investigations of anomalies of color Doppler detecting MAP were 90% and 89%, respectively. Our research supported this finding.

Also, Rac *et al.*<sup>23</sup> reported that although no studies have been performed that directly compare the accuracy rate of transabdominal vs. transvaginal ultrasound in the setting of suspected placental invasion, transvaginal ultrasound permits a more thorough evaluation of the lower uterine segment and is currently the suggested standard of care.

Our results regarding the comparison of bridging vessels between TAS and TVS, of the 92 positive bridging vessels TVS, 80 patients were positive bridging vessels. Thus, TVS accuracy was 72.5% and TAS was 76.7% in detecting bridging vessels; the results were statistically highly significant ( $P < 0.001$ ).

Chou *et al.*<sup>24</sup> revealed that high sensitivity and specificity for PAD were seen in the high-flow arteries connecting the placenta and the bladder. They cautioned, however, that caution must be used to demonstrate that these veins link the placenta and the bladder since two false positives were brought on by bladder varices in women who had already had cesarean sections.

## 5. Conclusion

Based on our findings, transabdominal ultrasound and transvaginal ultrasound are complementary for diagnosis; also, in situations of placenta previa, transvaginal ultrasonography is safe and enables thorough inspection of the lower uterine section.

## Disclosure

The authors have no financial interest to declare in relation to the content of this article.

## Authorship

All authors have a substantial contribution to the article.

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## Conflicts of interest

There are no conflicts of interest.

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