

layer of the rectum. In our experience, infiltration of the muscular layer is a critical parameter in determining the type of surgical excision of bowel endometriosis (nodulectomy or bowel resection) (Remorgida *et al.*, 2005). Excluding before surgery, the presence of endometriotic nodules reaching the muscular layer of the rectum is useful for the surgeon in order to obtain adequate consent from the patient and determining whether the assistance of a general surgeon is required (Remorgida *et al.*, 2007).

In their letter, Abrão *et al.* cited a previous study comparing TVS and magnetic resonance imaging (MRI) in the diagnosis of rectosigmoid endometriosis (Abrão *et al.*, 2007). This study showed that TVS had 98% sensitivity in diagnosing the presence of rectosigmoid endometriosis. Although the authors declared that the various layers of the bowel wall were examined in detail, no data were presented on the accuracy of TVS in determining the depth of infiltration of the endometriotic nodules in the layers of the bowel wall. Abrão *et al.* cited another study (Bazot *et al.*, 2003) which first showed the usefulness of TVS in diagnosing rectal endometriosis. In this study, TVS correctly diagnosed the infiltration of the muscularis propria in all the cases ($n = 18$). Unfortunately, we could not reproduce these results and we are not aware of publications of other groups confirming these findings in larger series. In addition, only 30 women were included in the study (Bazot *et al.*, 2003) and 60.0% of them (18/30) had involvement of the bowel muscularis. In our study, surgery revealed that rectal infiltration was present in 29 out of 90 women (32.2%). The prevalence of rectal infiltration in the studied population affects the positive predictive value of TVS; based on this, we believe that the findings of these studies cannot be truthfully compared.

It is well known that the accuracy of ultrasonography is dependent on the experience of the operator. Therefore, RWC-TVS may be useful for ultrasonographers who cannot diagnose the depth of infiltration of the rectal wall by TVS or when more experienced ultrasonographers cannot exclude the infiltration of the rectal muscularis. Obviously, we cannot exclude that some ultrasonographers may avoid the use of this technique for an accurate diagnosis of rectal endometriosis.

Abrão *et al.* are correct in stating that a simple rectal enema performed 1 h prior to the examination may be sufficient to eliminate the fecal residue in the rectosigmoid colon. Patients included in our study underwent RWC-TVS on the day of surgery after receiving a mechanical bowel preparation which is commonly used at our institute before laparoscopy. This experimental design of our study may be criticized and this limitation of the study design was discussed in the manuscript. We are now evaluating the effectiveness of RWC-TVS in patients who receive only a rectal enema before the exam; our preliminary unpublished observations in this clinical setting confirm the effectiveness of RWC-TVS in determining the presence of endometriotic nodules infiltrating the muscular layer of the rectum.

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Why twin pregnancies are more successful at advanced than young maternal age? A potential role of 'terminal reproductive investment'

Sir,

The article by Delbaere *et al.* 'Perinatal outcome of twin pregnancies in women of advanced age', in *Hum Reprod* (2008), showed that irrespective of reproductive techniques, socioeconomic status and the zygosity of twins, perinatal outcome of twin pregnancies is more favourable in primiparous women aged 35 or over compared with primiparous women aged 25–29 years. As stated by the authors themselves, this is a paradoxical phenomenon, because singletons born to older mothers are commonly at disadvantage (Tarin *et al.*, 1998). Both the physiological mechanisms and the ultimate causes behind this phenomenon remain unknown. Here, I propose one potential resolution, based on evolutionary theory, that might help shed light on the question why multiple pregnancies seem to have better outcome among older than young mothers.

Evolutionary theory predicts that in species reproducing many times during their lifetime, reproductive effort (the proportion of parental resources invested in offspring from conception to independence) should increase with advancing age, as ageing reduces their residual reproductive value due to the decreasing future probability of reproduction and survival (Clutton-Brock, 1984). This age-dependency of reproductive effort should eventually manifested itself as a terminal reproductive effort (thus, the term 'terminal investment hypothesis'), where individuals invest heavily in their last reproductive event because there is no future reproduction to lose. Women fit well with the assumptions of this hypothesis, because menopause sets a clear end-point to their fertility, making terminal reproductive effort a potentially advantageous reproductive strategy.

But how well this hypothesis fit with our knowledge on human multiple births and how might it advance our understanding of the age-dependent outcomes of multiple births? First, advanced maternal age has been regarded as one of the most important factors increasing the rate of heritable multiple births (e.g. dizygotic twins and trizygotic triplets) (Bulmer, 1970; Bortolus *et al.*, 1999; Hoekstra *et al.*, 2008). For example, between the ages 15 and 37, the dizygotic twinning rate has been reported to show more than a 4-fold increase (Bulmer, 1970). High parity has also been suggested to have an independent positive effect on dizygotic twinning rates (Bulmer, 1970). Both advanced maternal age and high parity are relevant to the terminal investment hypothesis, as they both point towards the end of a woman's reproductive lifespan: an age close to menopause represents a physiological constraint on fecundity, whereas high parity may indicate that a desired or, given an environmental-context, a maximum family size is almost accomplished. Second, multiple births have been considered to result from natural selection on more relaxed screening mechanisms of, for example, developing multiple embryos with increasing maternal age (Anderson, 1990; Forbes, 1997; Ball and Hill, 1999). This idea was originally developed to suggest that multiple births are, in terms of maternal evolutionary fitness, harmful side effects of such screening mechanisms. However, later studies have indicated that such mechanisms, if responsible for polyovulation, may have actually been selected for as older mothers can increase their reproductive effort and fitness by the production of multiple births (Lummaa *et al.*, 1998; Helle *et al.*, 2004). Third, mothers have been reported to be more likely to completely terminate their reproductive career after delivering a twins compared with mothers delivering singletons only (Lummaa, 2001; Pison and Couvert, 2004).

These findings suggest that older mothers may increase their reproductive effort by producing multiples. However, in order to be a strategy favoured by natural selection, the amount of investment in multiples conceived should also increase with the increasing maternal age (Clutton-Brock, 1984). The current evidence supports this. First, survival to independence or adulthood is an important proxy of post-partum maternal investment in offspring. Studies on the survival of twins compared with singletons have shown that even in premodern times twin births produced more adult offspring than singleton births (Lummaa *et al.*, 2001; Helle *et al.*, 2004) and that the survival of multiples is improved in older mothers compared with younger ones in both historical and contemporary populations (Volland and Gabler, 1994; Misra and Ananth, 2002; Zhang *et al.*, 2002; Imaizumi, 2003; Salihu *et al.*, 2004; Luke and Brown, 2007). Second, in contrast to singleton deliveries, twins born to older mothers are not in higher risk of very preterm birth compared to younger mothers (Blickstein *et al.*, 2001; Zhang *et al.*, 2002; Branum and Schoendorf, 2005; Delbaere *et al.*, 2008), and older mothers have been reported to give birth to heavier triplets than the younger mothers (Keith *et al.*, 2004; Blickstein *et al.*, 2005). Third, no adverse long-term effects of being a twin versus being a singleton on the adult-life reproductive performance and survival have currently been reported (Vagero and Leon, 1994; Christensen *et al.*, 1998, 2001). In sum, these findings indicate that

mothers invest more in multiple deliveries as they approach the end of their reproductive lives.

Therefore, the higher incidence of multiple births and their more favourable outcomes with advanced maternal age may, at least partly, be related to the increased reproductive effort by older mothers, as predicted by the terminal investment hypothesis. It, however, still remains an unanswered question why naturally occurring multiple births are rather rare events and not manifested by all reproducing old mothers? It is known that many more multiple conceptions are taking place than that are born (the 'vanishing twin' phenomenon; Landy and Keith, 1998) and that mothers delivering multiples are generally in good physiological condition and taller (Campbell *et al.*, 1974; Bortolus *et al.*, 1999; Madrigal *et al.*, 2001; Sear *et al.*, 2001; Basso *et al.*, 2004; Reddy *et al.*, 2005). This suggests that many women possess a genetic propensity to multiple births, potentially indicating a historical selection pressure for polyovulation, which is sensitive to maternal nutritional status and, hence, expressed mainly among those mothers who have abundant resources to increase their reproductive effort. Such a strategy has likely been adaptive, because multiple births have hardly been favoured in environments of low resource availability and poor offspring survival (Lummaa *et al.*, 1998). In addition, it is problematic why mothers having singletons only, who compromise the majority of the populations, do not generally seem to show an increased reproductive effort with age (Fessler *et al.*, 2005). More studies are needed thus to elaborate the evolutionary roots of multiple births in humans.

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