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Transvaginal duplex ultrasonography appears to be the gold standard investigation for the haemodynamic evaluation of pelvic venous reflux in the ovarian and internal iliac veins in women

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Abstract

Objectives: To assess the suitability of transvaginal duplex ultrasonography to identify pathological reflux in the ovarian and internal iliac veins in women.

Methods: A retrospective study of patients treated in 2011 and 2012 was performed in a specialised vein clinic. Diagnostic transvaginal duplex ultrasonography in women presenting with symptoms or signs of pelvic vein reflux were compared with the outcomes of treatment from pelvic vein embolisation. A repeat transvaginal duplex ultrasonography was performed 6 weeks later by a blinded observer and any residual reflux was identified.

Results: Results from 100 sequential patients were analysed. Mean age 44.2 years (32–69) with mode average parity of 3 (0–5 deliveries). Pre-treatment, 289/400 veins were refluxing (ovarian – 29 right, 81 left; internal iliac – 93 right, 86 left). Coil embolisation was successful in 86/100 patients and failed partially in 14/100 – 5 due to failure to cannulate the target vein. One false-positive diagnosis was made.

Conclusion: Currently there is no accepted gold standard for pelvic vein incompetence. Comparing transvaginal duplex ultrasonography with the outcome from selectively treating the veins identified as having pathological reflux with coil embolisation, there were no false-negative diagnoses and only one false-positive. This study suggests that transvaginal duplex ultrasonography could be the gold standard in assessing pelvic vein reflux.

Keywords

Duplex ultrasound, pelvic vein reflux, ovarian veins, internal iliac veins, varicose veins

Introduction

Pelvic venous reflux (PVR) of the ovarian veins or internal iliac veins is associated with pelvic congestion syndrome (PCS),[1–3] vulval varicose veins,[4,5] para-vulval varicose veins[4] and varicose veins in the legs.[6] It has previously been shown to be present in one in five women who present with leg varicose veins and have had previous vaginal deliveries.[2] Further work also determined that pelvic venous incompetence is associated with recurrent varicose veins in up to a third of women who are multiparous and have not undergone hysterectomy.[7]

However, there is currently no gold standard as to what investigation to use to identify and measure PVR. Contrast venography only shows the vessels into which the contrast flows and does not necessarily show physiological reflux; its contrast is injected under pressure and in the decubitus position, both of which are non-physiological. Computerised tomography (CT), contrast venography and magnetic resonance venography (MRV), all show vein diameters and the presence

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of pelvic varices but neither show real-time reflux in the truncal veins.[8]

This is a similar discussion to one held in the 1980 s and 1990 s when the optimal investigation into venous reflux in the truncal veins of the leg was being investigated. In leg vein incompetence, venous duplex ultrasonography was shown to be optimal, allowing both imaging as well as measurement of the venous function in terms of direction and flow of blood in real time.[9]

Following these principles, we instituted transvaginal duplex ultrasonography (TVS) in 1999 as the investigation of choice for suspected pelvic vein incompetence in women. We have found this to be an excellent investigation allowing us to identify reflux in the distal ovarian veins, internal iliac veins, uterine plexuses, haemorrhoids, vaginal varicose veins and vulval varicose veins. It does not allow good imaging of the common iliac veins nor the proximal ovarian veins and, if any obstruction such as a nutcracker compression syndrome is suspected, further imaging using transabdominal duplex ultrasound (DUS) or another modality is required. Transabdominal DUS may be employed in this situation and has also been successful in diagnosing PCS.[10]

However, due to the excellent views obtained of the distal ovarian veins and internal iliac veins, as well as reflux in tributaries leading to any varices within the pelvis, anal canal, vagina and vulva, TVS has become our standard investigation of pelvic vein incompetence and we use it for direct treatment of the reflux by transjugular coil embolisation. Figures 1 and 2 show greyscale TVS images of a left internal iliac vein and a left ovarian vein, respectively (left internal iliac vein also visible in Figure 2).

Recently, other investigators have started recommending different investigations for PVR including CT, MRV and transabdominal ultrasonography.[11,12] The aim of this study was to assess TVS as an investigation for pelvic venous incompetence, to see whether it could be accepted as the gold standard for investigating this condition.

Patients and methods

Presently there is no recognised gold standard in the investigation of PVR, although several authors claim it to be contrast venography.[10,13–15] This is somewhat problematic when assessing the accuracy of TVS, as there is no test to compare it to. In 1999 and 2000, in our unit, when pelvic venous incompetence was identified using TVS, coil embolisation was directed following the assessment of the pelvic veins at the time of contrast venography. Those veins thought to reflux on contrast venography or those that appeared to be abnormally dilated were embolised with coils, whereas those that appeared to be competent or of 'normal' calibre were not. Unfortunately, using this strategy, many patients continued to have gross reflux in their pelvic veins on follow-up TVS and it became clear that assessment of the pelvic venous incompetence by contrast venography at the time of coil embolisation was sub-optimal.

Since 2001, coil embolisation of the pelvic veins in our patients has been directed by the diagnostic information provided from the TVS. Veins that have been shown to be refluxing are embolised regardless of diameter and those that do not reflux are left without treatment even if they appear massively dilated and abnormal on venography at the time of treatment. Since instituting that policy, it has been our experience that the failures to correct the reflux in the pelvic veins have been minimal.

TVS is offered only to women whose lower limb duplex results suggest a pelvic contribution. Reflux in the para-vulval and gluteal veins may be suggestive of

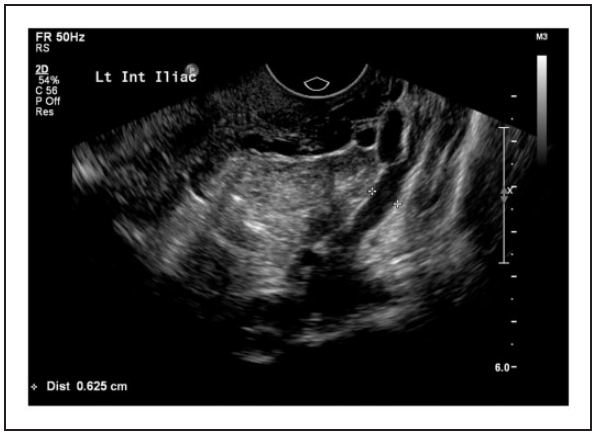

Figure 1. Ultrasound image of a left internal iliac vein.

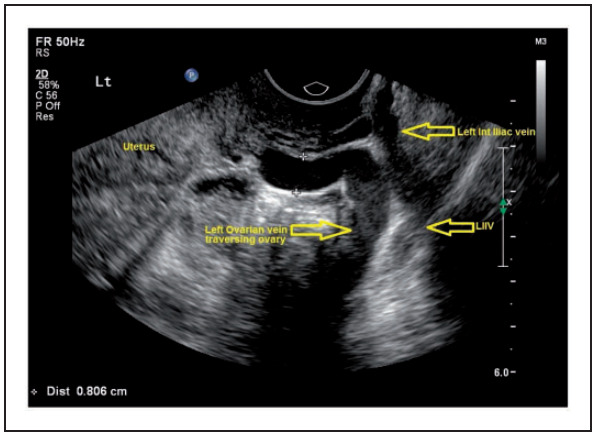

Figure 2. Ultrasound image of a left ovarian vein (LIIV also visible).
LIIV: left internal iliac vein.

PVR, as well as visible varicosities emanating from the pelvis (as can be seen in Figure 3). When using TVS to examine patients, our sonographers adhere to the Holdstock/Harrison protocol – conceived at our unit and continually developed over the course of 15 years. The labial, ovarian and internal iliac veins and their branches are assessed with the patient in a 45° head-up position. Although the procedure has been described elsewhere in more detail,[16] key criteria include the following ultrasonographic observations: (a) reflux and dilatation of the venous trunks on Valsalva, reflux must be >1 s within the venous trunks and persist until the end of the manoeuvre; (b) any associated varices should show flow reversal and distension on Valsalva; (c) either ipsilateral syphoning or contralateral dilation and syphon effects between the ovarian and internal iliac trunks and (d) trunk diameter is generally irrelevant and small trunks (i.e. <5 mm) must be considered.

There are no clearly defined cut-off criteria indicating whether pelvic reflux is of any haemodynamic significance; if the reflux is prolonged and evidently shown on TVS, it must be treated; however, if there is a minor amount over a long period, intervention is unnecessary. In this study, TVS results were used to direct coil embolisation of veins shown to reflux in accordance with the Holdstock/Harrison protocol. The decision to embolise was made by both the sonographer and consultant vascular surgeon if it was felt that the patient would benefit from the abolition of any reflux present.

Figure 3. Patient presenting with pelvic venous reflux.

The embolisation procedure is carried out using an aseptic technique, local anaesthesia and intravenous sedoanalgesia. A 5-French sheath was inserted using Seldinger's technique following a low right internal jugular vein puncture and the target veins are selectively catheterised and embolised with a number of 10, 16 and 18 mm platinum Spirale coils (BALT Extrusion, Montmorency, France). In some veins, coiling alone is not sufficient to achieve treatment. The choice of whether to use coils alone or a combination of coils and foam sclerotherapy depends on the venographic appearances of the pelvic veins identified as refluxing by the TVS venous map.

The parietal branches of refluxing internal iliac veins (i.e. obturator and vulval branches) are almost always treated with foam, made from a 50:50 mixture of $O_2$and CO_2 with 3% sodium tetradecyl sulphate (Fibrovein, STD Pharmaceutical Products Ltd., Hereford, UK). Foam is ideal for the treatment of the most distal vulvovaginal and haemorrhoidal tributaries; however, the main truncal branches of all pelvic veins are always coiled. It is rare that visceral branches (internal pudendal from the internal iliac veins and the ovarian veins themselves) require treatment with foam. Typically, patients with more severe reflux require considerably more coils than those whose reflux is milder.

Patients were then reassessed with TVS (blinded at the time of the investigation to the procedure that has been performed and to the results of the initial TVS) to see if there is any residual pelvic reflux. If any pelvic venous reflux is found at the second TVS, the patient notes are requested from the interventional radiologist to find out which veins were embolised. It is then determined if the latter correlates with the primary diagnostic TVS to assess whether the reflux constitutes inadequate treatment, failed treatment or de novo reflux.

Therefore, we were able to use the results from the follow-up scan to assess whether the initial diagnostic TVS correctly identified the refluxing pelvic trunks that were treated and whether it also identified the competent pelvic veins that were not treated.

The notes from 100 sequential female patients (mean age 44.2 years, range 32–69), who were assessed with TVS in our unit in 2011 and 2012 and who had subsequently undergone transjugular coil embolisation directed upon the results of this test, were analysed retrospectively. Clinical presentation information of all patients can be seen in Table 1 and CEAP scores for all patients presenting with lower limb varicose

Table 1. Patient clinical presentation.

Presentation	Number of patients
Lower limb varicose veins	75
PCS	4
Thread veins	1
Lower limb and vulval varicose veins	18
Lower limb varicose veins and PCS	2

PCS: pelvic congestion syndrome.

Table 2. Patient CEAP scores.

CEAP right	Number of patients	CEAP left	Number of patients
0	2	0	2
1	19	1	16
2	59	2	63
3	7	3	10
4	7	4	4
5	0	5	0
6	1	6	0

Table 3. Parity status of 100 female patients.

Number of deliveries	Number of patients
0	5
1	14
2	29
3	41
4	7
5	4

veins are shown in Table 2. Patients presenting with PCS reported characteristic symptoms of the condition such as a 'dragging' sensation in the pelvis and dyspareunia. The initial results from the diagnostic TVS were noted along with the radiological report of the embolisation procedure. Finally, the results from the subsequent TVS were obtained and compared with the diagnostic TVS and the radiological report of which veins had been embolised. Parity ranged from zero to five deliveries, with just under half of the patients having had three deliveries (see Table 3).

Success of pelvic vein embolisation was defined in one of two ways: (a) a vein diagnosed as competent by TVS was not embolised and showed no reflux at a 6 week follow-up scan and (b) a vein diagnosed as incompetent by TVS was embolised and showed no reflux at a 6 week follow-up scan.

Failure of embolisation was defined in one of three ways: (a) a technical failure of pelvic vein embolisation; (b) overtreatment – a vein diagnosed as competent by TVS was embolised due to venographic appearance and showed no reflux at a 6 week follow-up scan; and (c) undertreatment – a vein diagnosed as incompetent by TVS was not embolised due to venographic appearance and showed reflux at a 6 week follow-up scan.

Results

The clinical outcome of embolisation (e.g. patient reported outcomes) was not assessed in this study. The absence, persistence or cessation of any reflux identified by TVS at 6 weeks post-procedure was recorded; thus, the endpoint for haemodynamic evaluation of the pelvic veins was taken to be the cessation of reflux. TVS identified reflux in 100 patients (289/400 veins incompetent, 111/400 veins competent). Complete success with the elimination of all pelvic vein reflux was achieved in 55 patients (220/400 veins), with a further 31 patients (124/400 veins) having trickle reflux only in tributaries of treated veins that was clinically insignificant (i.e. did not lead to symptoms of lower limb/vulval varicose veins or PCS). This gives a success rate of 86%.

The remaining 14 patients (56/400 veins) had significant venous reflux in at least one vein, or in the tributaries of such, at the second TVS (in a total of 19/400 veins). However, it should be noted that these patients all displayed markedly less reflux overall and in fewer veins than at the time of the original diagnostic TVS; therefore, no patients had complete failure of the treatment. A total of 381/400 pelvic veins (95.3%) were free from reflux after embolisation.

The distribution of pelvic veins treated by coil embolisation is noted in Figure 4, with the modal pattern being left ovarian vein reflux with concurrent bilateral internal iliac vein reflux (42%). Isolated ovarian vein reflux was observed only in a single patient (left ovarian vein).

Analysis of the 14 patients (19/400 veins) with significant clinical reflux following treatment shows that in three cases the reflux was due to failure to cannulate and hence embolise an ovarian vein – two failures on the right side and one on the left. One patient had failure due to the embolisation of a left ovarian vein only when the diagnostic TVS had shown reflux in the left ovarian and bilateral internal iliac veins. However, the interventional radiologist had felt the bilateral internal iliac veins appeared normal on catheter venography and so, contrary to our usual protocol, had decided not to embolise them. As one might expect, subsequent blinded TVS revealed no reflux in either ovarian vein; however, bilateral internal iliac reflux was observed and

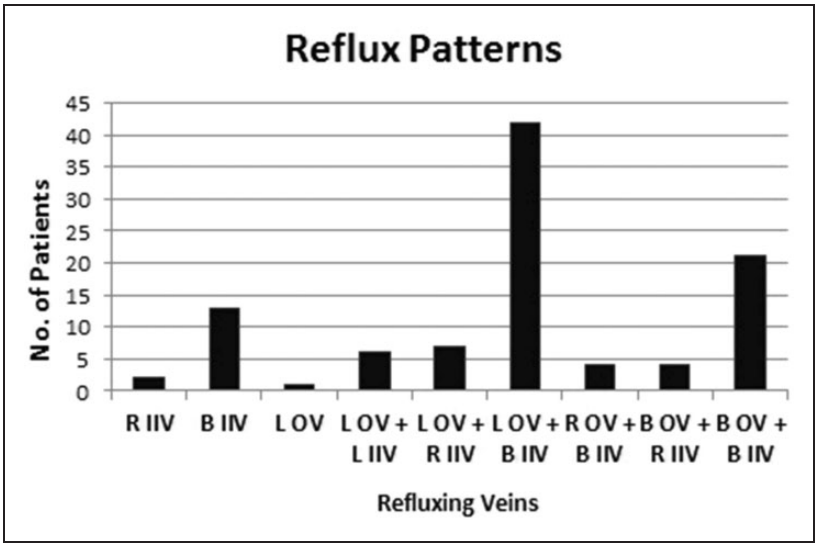

Figure 4. Distribution of refluxing pelvic veins.
L: left; R: right; B: bilateral; OV: ovarian vein; IIV: internal iliac vein.

the patient underwent a repeat embolisation that resolved the issue.

All of the other 10 cases of residual reflux were technical failures of embolisation. In each case, the correct vein had been catheterised and embolised but, for a variety of reasons, subsequent TVS showed reflux within the vein or within tributaries from that trunk. Coils in two patients (3/400 veins) migrated to the uterine plexus, which permitted the pelvic veins to reflux. Embolisation of the right internal iliac vein failed in five patients, accounting for the persistent reflux seen after treatment. Three patients (6/400 veins) achieved total elimination of reflux in the truncal veins but had continuing reflux in the tributaries of a variety of veins. As far as this study is concerned, however, all of these cases point to the success of the diagnostic TVS identifying pathological reflux and the presence of reflux subsequently due to technical failure of the embolisation only reinforces the initial diagnosis of reflux in the target vein by the TVS.

In five patients, there was an undertreatment of veins by coil embolisation, where the radiologist did not specifically treat all of the target veins identified on diagnostic TVS. In one of these cases, a patient was diagnosed as having reflux in all four veins, but at embolisation the right ovarian vein was not treated. In this case, despite the lack of embolisation of the right ovarian vein, reflux was completely eliminated in the pelvis at subsequent TVS and so this was noted as a failure of diagnostic TVS.

In all of the other four cases (two of which were suspected of having Nutcracker syndrome), the target vein itself was not catheterised and embolised; however, it was noted that the catheter passed into the distal truncal vein through the varicose plexuses in the pelvis when one of the other truncal veins was being treated, effectively treating this target vein.

In eight cases, extra veins were treated apart from those that had been identified as refluxing on initial diagnostic TVS. In two of these cases, the left ovarian veins were embolised on size alone, despite there being no radiological or TVS evidence of reflux in any of these veins. Similarly, two other cases saw the right internal iliac veins embolised due to their size. In the other four cases, the second internal iliac vein was embolised in addition to the primary target internal iliac vein. In each of these cases, the right internal iliac vein was accessed through cannulation of the left internal iliac vein and the catheter passed across the midline accessing the right internal iliac vein from below. Coil embolisation was then performed of the target vein. However, in these four patients, both veins were embolised by the coils due to the large volume of the pelvic varices being embolised. Not surprisingly, all of the eight cases of overtreatment of non-refluxing veins in addition to the veins shown to be refluxing on TVS showed successful treatment, with absence of reflux or trickle reflux only on follow-up TVS.

Discussion

Pelvic venous incompetence with associated venous reflux is recognised as the cause of several clinical problems, as stated in the introduction. Hence, there is a need for effective treatment of the incompetent ovarian and internal iliac veins. We have previously reported our success of treatment of these pelvic veins with transjugular coil embolisation under X-ray control.[17]

However, in order to identify which veins require treatment, and to assess whether such treatment has been successful, it is essential to have a 'gold standard' test for pelvic venous incompetence. We have been using TVS since 2000 for both diagnosis of PVR as well as the assessment of the success of treatment. Other workers in this field have reported other modalities including transabdominal DUS, contrast venography, CT and magnetic resonance imaging (MRI).[10,13,18,19]

While there is an absence of any clinical data relating to the improvement of initial patient symptoms, the authors would like to stress that this article concerns the haemodynamic assessment of PVR with TVS as opposed to the clinical outcomes of treatment directed by TVS, the latter being a subject of further research underway in our unit. We acknowledge that haemodynamic results (i.e. the cessation of reflux) are not a substitute for true clinical endpoints but wish to emphasise that this is not the issue addressed by this study. Other limitations of the study include the selection bias present in the patient cohort (from assessing only patients whose lower limb DUS suggested a pelvic contribution) and the retrospective design. Despite these drawbacks – with only one false-positive and no false-negatives – our data clearly show that TVS is of vital importance in the haemodynamic evaluation of the pelvic veins.

Multiple authors assert that duplex ultrasonography should be the first imaging technique used in the case of patients with chronic venous disease.[5,10,12] Compared to other imaging techniques, DUS does not expose the patient to any ionising radiation, is widely available and non-invasive (somewhat minimally in the case of TVS but much less so than venography), but perhaps the greatest advantage that ultrasound has over other commonly used methods is its capability of detecting any haemodynamic changes in the vessels under examination. Despite these advantages, TVS requires a certain amount of experience on the part of the sonographer and so the outcome of the investigation may differ depending on the operator's skill.

Typically, the investigation takes a mere 5–7 min to perform with complex cases requiring only slightly longer – no more than 15 min. TVS is somewhat limited in that it cannot visualise the proximal ovarian veins but despite this the distal 6–8 cm can be clearly seen and in the event that the vein is largely dilated, there will almost certainly be incompetence and reflux further up. To confirm this, other diagnostic imaging modalities may be employed either independently or at the time of treatment. While TVS gives a superb view of the pelvic veins, the interpretation of any reflux is somewhat subjective. In addition to this, there is the possibility that the patient is unable to perform a Valsalva. In this case, patients are given an empty, sterile syringe and instructed to blow into it. This simulates the effects of the Valsalva manoeuvre and allows the investigation to continue unhindered.

Perhaps the most obvious limitation of TVS is its gender specificity. Transperineal and transanal DUS have both been explored as potential alternatives but there is difficulty in positioning the ultrasound probe so that the vessels may be properly examined. It is also not unreasonable to suggest that obtaining informed consent to perform a transanal scan could prove troublesome in a large number of male patients. Compared to female PVR, our unit has dealt with an incredibly small number of male PVR cases. In these situations, MRI was used to confirm the presence of testicular and/or internal iliac vein reflux. While this seems contradictory to the arguments made in this article, there is currently no male equivalent to TVS and so the interventional radiologist deemed the use of MRI to be necessary in these situations.

A further limitation of the technique is its inability to assess patients who suffer from vein compression such as May–Thurner or Nutcracker syndromes. These patients have no phasic flow and venous collaterals may be observed on the transvaginal scan. For these patients, transabdominal duplex may be used to assess the proximal ovarian veins. Unfortunately, the view of the distal ovarian veins is relatively poor compared to TVS and the internal iliac veins can only be seen clearly in thinner patients.

Two patients in our cohort were suspected of having Nutcracker syndrome. In both of these patients, the left ovarian vein was inaccessible during embolisation and it was not possible to selectively catheterise them. Fortunately, the interventional radiologist was able to access both of these veins from below, via a catheter passed through pelvic varices. There is a paucity of epidemiological data concerning Nutcracker syndrome in the literature and its prevalence remains somewhat unknown. Scultetus et al.[20] observed the condition in 9/51 patients (17.6%) presenting with PCS. In our own practice, however, we have observed a far lower prevalence in a total cohort exceeding 1000 patients.[21]

Owing to the lack of a gold standard assessment, we need to use the outcome of the treatment directed by the test as the factor to assess the accuracy and diagnostic value of TVS. Eighty-six patients (381/400 veins) achieved success of the treatment directed by TVS. Veins diagnosed as incompetent were successfully embolised with complete or almost complete abolition of reflux and those veins diagnosed as competent were left alone and no reflux was found from them after the other pathological veins in the pelvis had been treated.

Despite the elimination of reflux in the eight patients who were overtreated and in the five who were

undertreated, we have classed the outcome of the treatment as a partial failure. Compared to the initial TVS, more veins than necessary were treated – the radiologist was, in essence, treating a 'normal' vein. We view this as a failure to embolise the correct (incompetent) veins. Concerning undertreatment, the refluxing veins (excluding the one failure of diagnostic TVS) were treated from other access routes. Although the reflux was eliminated, the veins in question were not directly embolised; thus, the embolisation 'failed'. On the contrary, we feel it would not reflect the true outcome of the procedure if these 13 patients were grouped alongside the 14 whose reflux persisted after embolisation and so they have been included in the 86/100 successes.

As mentioned previously, the arguments put forth in this article mimic those made over two decades ago, when the optimal investigation for truncal vein reflux was in question – the only difference in this situation being that pelvic veins are somewhat less accessible and require a greater degree of skill to examine. A solid diagnosis of pelvic vein incompetence should include visual evidence of reflux during the assessment. The nature of CT and MRI (as well as MRV and contrast venography to a lesser extent) prevents this and so it is entirely possible that incompetent pelvic veins may well be overlooked and classed as competent and vice versa. For this reason, we do not believe that conventional venography can be considered the gold standard for diagnosing incompetent pelvic veins in women, nor would we advocate the use of the above techniques for PVR diagnosis.

We conclude that TVS can be considered as the gold standard investigation for the haemodynamic assessment of PVR in women and should be used instead of, or alongside, other diagnostic imaging methods. Using the outcome of pelvic vein embolisation to assess the value of TVS in place of a gold standard test did not invalidate the results of this study; instead, it helped to reinforce the diagnosis. Further research into imaging methods used to diagnose female pelvic vein incompetence should consider, including a comparison to TVS.

Conflict of interest

None declared.

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