Table 1 Risks and benefits of single-dose intraoperative i.v. dexamethasone.

Substantiated risks	Unsubstantiated risks	Benefits
• Mild increase in blood glucose especially in patients with diabetes mellitus • Perineal pruritus	• Increased risk of infection • Impaired wound healing • Increased risk of anastomotic leak • Increased risk of postoperative haemorrhage	• Reduces postoperative pain • Reduces postoperative opioid requirements • Reduces postoperative nausea and vomiting • Reduces postoperative fatigue • Improves quality of recovery • Decreases incidence and severity of sore throat after extubation • Reduces pain intensity and opioid requirements after spinal anaesthesia • Reduces rebound pain after peripheral nerve block

risk of infection, delays wound healing, or precipitates either postoperative haemorrhage or anastomotic breakdown.5.

Given the favourable balance of evidence, as summarised in Table 1, we contend that there is a growing argument to consider administration of a single intraoperative dose of i.v. dexamethasone to most surgical patients after appropriate, individualised assessment of patient risk and benefit. In the meantime, further research should be undertaken to identify strategies to minimise the impact of the unpleasant pruritus when i.v. dexamethasone is administered to awake patients undergoing regional anaesthesia.

Declarations of interest

The authors declare that they have no conflicts of interest.

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Ultrasound-guided dynamic needle tip positioning *versus* conventional palpation approach for catheterisation of posterior tibial or dorsalis pedis artery in infants and small children

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Editor—The utility of the ultrasound-guided dynamic needle tip positioning (DNTP) approach for radial artery catheterisation has been reported in paediatric patients.[1,2] In DNTP, the actual needle tip can be seen by moving the needle and ultrasound probe alternately until the tip of the outer catheter can be inserted into the vessel.[3–6] However, no studies have compared this approach to the conventional palpation technique in the posterior tibial or dorsalis pedis artery.

The aim of this randomised controlled trial was to compare the success rates of the DNTP and palpation technique in posterior tibial and dorsalis pedis artery catheterisation in paediatric patients. We also aimed to compare the success rates of the DNTP between the two arteries. The study protocol was approved by the Institutional Review Board of Osaka Women's and Children's Hospital, Osaka, Japan. Written informed consent was obtained from the parents of each patient. This trial was registered at the University Hospital Medical Information Network (UMIN) Clinical Trials Registry (UMIN000037874; registered September 1, 2019).

A total of 140 paediatric patients aged <3 yr old who underwent cardiovascular surgery between September 2019 and August 2020 were randomly allocated to one of the following four groups according to puncture site and procedure: ultrasound-guided posterior tibial artery (US-PTA) group, palpation posterior tibial artery (P-PTA) group, ultrasound-guided dorsalis pedis artery (US-DPA) group, or palpation dorsalis pedis artery (P-DPA) group. Patients who underwent emergency surgery or in whom an arterial catheter had already been inserted were excluded.

Four anaesthesiologists with 5–8 yr of experience performed all catheterisation procedures in the posterior tibial or dorsalis pedis artery with a 24G needle (Jelco Plus; Smiths Medical Japan, Tokyo, Japan) using either the ultrasound-guided DNTP approach as described[2,6] or a palpation technique. A Sonosite M-Turbo ultrasound system (Fujifilm Medical, Tokyo, Japan) with an SLAx/13-6 MHz probe (hockey stick type) was utilised for ultrasonographic examinations. Ankle dorsiflexion and eversion were performed with tape for the posterior tibial artery, whereas ankle plantar flexion was performed with tape for the dorsalis pedis artery.[7] All procedures were performed with a 30–45° puncture angle relative to skin.

The primary outcome was first-attempt success rates of arterial catheterisation between the US-PTA and P-PTA groups and between the US-DPA and P-DPA groups. Overall success rate within 10 min, catheterisation time, and number of attempts were the secondary outcomes. Secondary outcomes also included comparisons of these outcomes and arterial characteristic (depth and diameter) between the US-PTA and US-DPA groups. We defined catheterisation time as time from skin puncture to completion of cannulation. If catheterisation required >10 min, it was regarded as a failure; in such cases, catheterisation time was recorded as 600 s. The following data were also recorded: sex, age (months), height (cm), weight (kg), puncture side (left or right), noninvasive systolic and diastolic pressure in the upper arm immediately before the procedure, presence of trisomy 21, coarctation of the aorta, or presence of an interrupted aortic arch.

Sample size calculation was based on previous studies for radial artery cannulation in paediatric patients.[8,9] We estimated that 27 subjects per group (108 total) would provide 80% power for detecting an improvement in the first-attempt success rate from 40% to 80% at an α level of 0.025 for Bonferroni correction (for two comparisons as primary outcomes). Hence, we enrolled 140 patients to allow for potential drop-outs. χ^2 test, Fisher's exact test, and Mann–Whitney *U* test were used to compare outcomes. A *P*-value of <0.025 was considered statistically significant for the primary outcome with Bonferroni correction. As for other outcomes, $P<0.05$ was considered statistically significant. Sample size calculation and statistical analyses were performed using StatFlex software version 6.0 (ARTECH, Osaka, Japan).

A total of 146 patients were assessed for eligibility. Six were excluded because arterial catheters were already inserted, and 140 were randomised into the four groups (all $n=35$). The characteristics and measured outcomes of the subjects are summarised in Table 1.

For the posterior tibial artery, the first-attempt (82.9 *vs* 22.9%, $P<0.001$; relative risk [RR]=3.6; 95% confidence interval [CI], 1.9–6.8) and overall (85.7 *vs* 40%, $P<0.001$; RR=2.1; 95% CI, 1.4–3.3) success rates were higher in the US-PTA group than in the P-PTA group. Catheterisation time was shorter ($P<0.001$) and number of attempts was lower ($P<0.001$) in the US-PTA group than in the P-PTA group.

For the dorsalis pedis artery, the first-attempt (85.7 *vs* 25.7%, $P<0.001$; RR=3.3; 95% CI, 1.9–5.9) and overall (91.4 *vs* 54.3%, $P<0.001$; RR=1.7; 95% CI, 1.2–2.3) success rates were higher in the US-DPA group than in the P-DPA group. Catheterisation times were shorter ($P<0.001$) and number of attempts was lower ($P<0.001$) in the US-DPA group than in the P-DPA group.

No significant differences in first-attempt and overall success rates, catheterisation time, number of attempts, and arterial diameter were observed between the US-PTA and US-DPA groups. However, arterial depth was greater in the US-PTA group than in the US-DPA group ($P=0.01$).

We found that DNTP was useful for catheterisation of the posterior tibial and dorsalis pedis arteries in paediatric patients compared with the palpation technique. The low success rates for the palpation technique support our results, which confirmed the superiority of the DNTP for the posterior tibial or dorsalis pedis artery catheterisation in paediatric patients. The first attempt success rates of the DNTP were similar between the two arteries. A previous study reported that the first-attempt success rate of ultrasound-guided long-axis in-plane approach for the dorsalis pedis artery was lower than that for the posterior tibial artery in paediatric patients.[7]

Table 1 Characteristics and measured outcomes. Data are expressed as number (%), median (inter-quartile range), or medians (inter-quartile range, range). *P<0.001 *vs* P-PTA group. †P=0.74 *vs* US-DPA group. ‡P<0.001 *vs* P-DPA group. ¶P=0.71 *vs* US-DPA group. §P=0.14 *vs* US-DPA group. ||P=0.97 *vs* US-DPA group. #P=0.01 *vs* US-DPA group. **P=0.06 *vs* US-DPA group. CoA, coarctation of the aorta; dBP, diastolic blood pressure; IAA, interrupted aortic arch; P-DPA, palpation dorsalis pedis artery; P-PTA, palpation posterior tibial artery; sBP, systolic blood pressure; US-DPA, ultrasound-guided dorsalis pedis artery; US-PTA, ultrasound-guided posterior tibial artery

Characteristics	US-PTA group (*n*=35)	P-PTA group (*n*=35)	US-DPA group (*n*=35)	P-DPA group (*n*=35)
Sex (male)	22 (62.9%)	22 (62.9%)	18 (51.4%)	19 (54.3%)
Age (months)	9 (2–14)	7 (2.3–12.8)	5 (1.3–15)	7 (1–13.5)
Height (cm)	63.5 (53.5–73.4)	62 (54–71.3)	63.9 (52.6–73.4)	63.5 (49.1–70.9)
Weight (kg)	5.8 (3.7–8.6)	5.4 (4.3–7.9)	6.3 (3.7–8.6)	5.6 (3.5–7.8)
Side (left)	20 (57.1%)	18 (51.4%)	19 (54.3%)	18 (51.4%)
sBP (mm Hg)	81 (67.8–95)	81 (69.3–92.8)	83 (69.3–88)	81 (71.3–91.8)
dBP (mm Hg)	39 (33–45)	42 (30.5–49)	39 (32.3–46.8)	40 (31–45)
Trisomy 21	4 (11.4%)	3 (8.6%)	3 (8.6%)	1 (2.9%)
CoA or IAA	3 (8.6%)	3 (8.6%)	1 (2.9%)	1 (2.9%)
Outcomes				
First attempt success	29 (82.9%)*,†	8 (22.9%)	30 (85.7%)‡	9 (25.7%)
Overall success	30 (85.7%)*,¶	14 (40%)	32 (91.4%)‡	19 (54.3%)
Catheterisation time (s)	63*,§ (51.5–98)	600 (155.3–600)	55‡ (40.8–73.5)	245 (104–600)
Number of attempts	1*,|| (1–1, 1–3)	3 (2–3, 1–4)	1 (1–1, 1–2)	2 (1.3–3, 1–4)
Arterial depth (mm)	3.6# (2.83–4.75)	3.5 (2.9–4.23)	2.9 (2.3–3.75)	2.8 (2.4–3.4)
Arterial diameter (mm)	1.1** (0.93–1.48)	1.1 (1.0–1.2)	1.0 (0.9–1.18)	1.1 (0.9–1.2)

However, with the use of DNTP, the dorsalis pedis artery can serve as an alternative access site to the posterior tibial artery.

In conclusion, the DNTP was superior to palpation for catheterisation of the posterior tibial or dorsalis pedis artery in paediatric patients. Furthermore, the dorsalis pedis artery was not inferior to the posterior tibial artery with respect to the success of the DNTP and may be an alternative access site.

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Declarations of interest

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