

# Which is the best site for catheter placement in young children with Type 1 Diabetes (T1D) and CSII ?

M. Xatzipsalti<sup>1</sup>, M. Vakaki<sup>2</sup>, K.Patouni<sup>1</sup>, A. Kourti<sup>1</sup>, L. Mentesidou<sup>1</sup>, A. Choundala<sup>2</sup>, L. Stamoyannou<sup>1</sup>, A. Vazeou<sup>1</sup>

<sup>1</sup>Diabetes Centre, A' Department of Pediatrics, P&A Kyriakou Children's Hospital, Athens, Greece, <sup>2</sup>Radiology Department, P&A Kyriakou Children's Hospital, Athens, Greece

## INTRODUCTION- OBJECTIVES

Insulin is delivered subcutaneously (SC) traditionally, although intradermal administration is under investigation for faster insulin absorption. Intramuscular (IM) insulin injection accelerates and increases insulin absorption and glucose-lowering activity, depending on the state of muscle activity. (1,2). Previous studies have shown that SC layer varies greatly based on the gender, body mass index (BMI) and different insulin injection sites in children (3,4). Few data exist for young children regarding the proper site for insulin injection with pen needles or even with insulin catheter for pump (CSII) users, based on the thickness of skin and SC using ultrasound (US) technique (5,6). The aim of this pilot study was to evaluate the proper site for catheter insertion in very young children (<8 year old) with T1D and CSII.

## METHODS

The study comprised 10 children (7 females, and 3 males) aged 2,3-7,2 yr ( median age 4.43 years) with T1D (median disease duration 1.65 years) who were on CSII and attended Diabetes Center, A' Department of Pediatrics, P&A Kyriakou Children's Hospital in Athens, Greece. From each patient, the following demographic parameters were obtained : date of birth, sex, age, weight, height, date of diagnosis of diabetes, number of injections/bolus per day, daily basal rate for insulin infusion, and catheter injection sites. Waist and hip circumference, upper arm and thigh mid circumference diameter were measured. Skin folds at catheter insertion site were also taken. The thickness of SC tissue was measured by using US bilaterally in all catheter injection sites: arm, thigh, abdomen and buttocks (fourteen measurements per child). Measurements were made in all sites, regardless of whether the child injected in the site or not. The measurement location was standardized using skin surface or palpable landmarks in order to reduce intersubject measurement variability. During the examination the child had a snack, injected the appropriate units of insulin through the catheter (fig 6) and immediately after we measured the insulin infusion in the SC tissue as well as the distance from the end of insulin infusion to muscular fascia (fig 5). US measurement was performed by a linear 9-15 Mhz transducer. All children used the 6 mm catheter.

## RESULTS

►The buttock and the side upper third of the thigh (SUTT) were the sites with the deepest SC fat compared with the upper, the lower abdomen, the front and back side of the arm (Table )(fig1,2,3,4) [buttock vs upper (p<0.0005) vs lower abdomen (p=0.002) vs front of the arm (p=0.006) and SUTT vs upper (p<0.0005) vs lower (p=0.010) abdomen vs front of the arm (p=0.024)].  
 ►The distance from the end of insulin infusion to muscular fascia was significantly less in the abdomen compared with the buttock (p=0.020), reaching the muscular fascia in all children with the abdominal catheter (fig5).  
 ►BMI, waist circumference and skin folds were not different between those whose distance between end of insulin infusion to muscular fascia was <0.5 cm vs >0.5 cm.

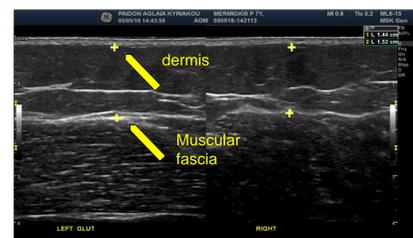


Fig 1. U/S photo from SC thickness from buttock



Fig 2. U/S photo from SC thickness from SUTT



Fig 3 U/S photo from SC thickness from right/left abdomen

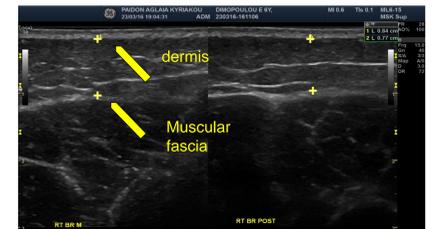


Fig 4 U/S photo from SC thickness from front, back side of arm

Table .

SC thickness	cm ± SD
Buttock	1.56±0.55
Side upper third of the thigh (SUTT)	1.49 ± 1.00
Upper abdomen	0.39 ± 0.20
Lower abdomen	0.60 ± 0.37
Front side of the arm	0.69 ± 0.16
Back side of the arm	0.96 ± 0.27



Fig 6 U/S photo from catheter of insulin pump

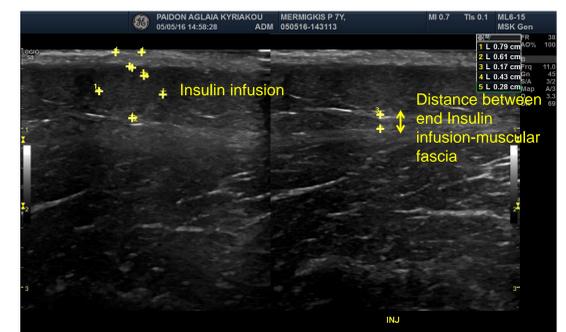


Fig 5 U/S photo during the insulin infusion through catheter. Insulin leakage seems like nebula between skin layer and muscular fascia

## CONCLUSIONS

On the basis of the mean values of SC thickness, it seems that in very young children with T1D and CSII the buttock and the SUTT are better sites for catheter placement compared with the abdomen and the arm. This, however, warrants further investigation with greater sample size.

## References

1. Thow, J.C., et al., *Different absorption of isophane (NPH) insulin from subcutaneous and intramuscular sites suggests a need to reassess recommended insulin injection technique.* Diabet Med, 1990. 7(7): p. 600-2.
2. Frid, A., et al., *Effects of accidental intramuscular injection on insulin absorption in IDDM.* Diabetes Care, 1988. 11(1): p. 41-5.
3. Birkebaek, N.H., A. Johansen, and J. Solvig, *Cutis/subcutis thickness at insulin injection sites and localization of simulated insulin boluses in children with type 1 diabetes mellitus: need for individualization of injection technique?* Diabet Med, 1998. 15(11): p. 965-71.
4. Smith, C.P., et al., *Subcutaneous or intramuscular insulin injections.* Arch Dis Child, 1991. 66(7): p. 879-82.
5. Hirsch, L., K. Byron, and M. Gibney, *Intramuscular risk at insulin injection sites--measurement of the distance from skin to muscle and rationale for shorter-length needles for subcutaneous insulin therapy.* Diabetes Technol Ther, 2014. 16(12): p. 867-73.
6. Lo Presti, D., C. Ingegnesi, and K. Strauss, *Skin and subcutaneous thickness at injecting sites in children with diabetes: ultrasound findings and recommendations for giving injection.* Pediatr Diabetes, 2012. 13(7): p. 525-33.