References

1. Yearbook of Pediatrics. Edited by SS Gellis. Chicago, Yearbook Medical Publishers, 1966, pp 374-375
2. Lloyd-Roberts GC, Thomas TG: The etiology of quadriceps contracture in children. J Bone Joint Surg [Brit] 46:498-502, 1964
3. See G, Briard J, Czernichow P: Fibrose du quadriceps consécutive à des injections intra-musculaires pratiquées chez le prématuré et le nourrisson. Ann Pediat (Paris) 44:360-366, 1968
4. Gunn DR: Contracture of the quadriceps muscle: a discussion on the etiology and relationship to recurrent dislocation of the patella. J Bone Joint Surg [Brit] 46:492-497, 1964
5. Masse P, Poujol J, Bigan R: À propos de trois cas d'enraidissement en extension du genou par fibrose progressive du quadriceps chez l'enfant. Arch Franc Pédiat 22:697-705, 1965
6. Malek R: Rétractions quadricipitales et injections intra-musculaires chez l'enfant. Ann Chir Infant 7:85-91, 1966
7. Engel WK: Focal myopathic changes produced by electromyographic and hypodermic needles: "needle myopathy." Arch Neurol (Chicago) 16:509-511, 1967
8. Aberfeld DC, Bienenstock H, Shapiro MS, et al: Diffuse myopathy related to meperidine addiction in a mother and daughter. Arch Neurol (Chicago) 19:384-388, 1968
9. Gray JE: Local histologic changes following long-term intramuscular injections. Arch Path (Chicago) 84:522-527, 1967

BRIEF RECORDINGS

Popsicle Panniculitis*

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A RED nodule on an infant's face may provoke mutilating or potentially dangerous intervention such as biopsy or antibiotic administration. This report describes a rarely recognized but probably quite common and benign cause of such a lesion.

CASE REPORT

At the age of 12 weeks, this infant's weight and height were above the 90th percentile; she subsequently drank low-fat milk.

At 6 months of age, a deeply situated, movable, firm, slightly elevated, warm red nodule 2 cm in diameter on the right cheek, adjacent to the mouth, developed over 24 hours (Fig. 1). There was no fever or palpable lymph-node enlargement. During the next week the induration gradually diminished, and transient fine desquamation overlying the nodule occurred. Light-brown hyperpigmentation developed, gradually disappearing over the next month to leave clinically unblemished skin.

Further questioning revealed that 2 days before the appearance of the nodule the infant had eaten a Popsicle, which had rested intermittently against the subsequently involved site for approximately 5 minutes.

Application of ice to the child's buttock for 2 minutes reproduced the clinical lesion. The patient's serum contained no detectable cryoprotein.†

At 11 months of age a similar but less severe and more transient lesion developed after the child ate a Popsicle.

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†Kindly performed by Dr. William D. Terry and the NCI Immunoglobulin Reference Center, Springfield, Va.

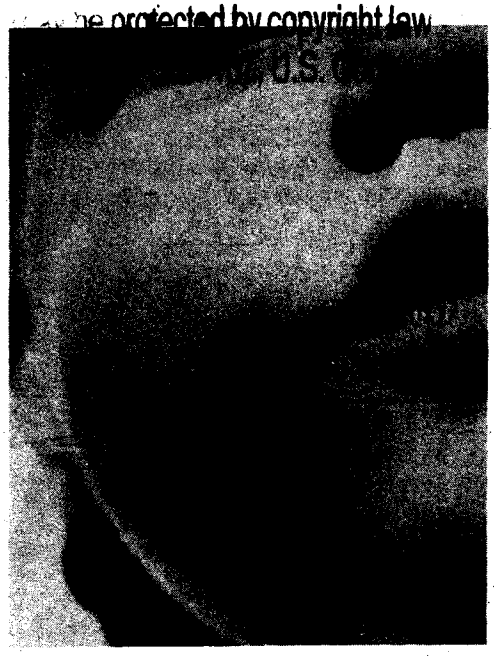

FIGURE 1. *Panniculitis of the Right Cheek Five Days after the Popsicle Was Eaten.*

DISCUSSION

Although the development of panniculitis after exposure to cold was recognized 30 years ago[1] few cases have been reported.[2-6] Most patients have been infants.

Biopsies show subcutaneous inflammation, with normal epidermis and dermis.[1-6] No circulating cryoproteins have been found,[3-5] and attempts to transfer reactivity passively by local injection of serum have been unsuccessful.[5]

Applying ice for 50 seconds produces nodules in all newborn infants, in 40 per cent of those six months old and in occasional nine-month-old infants.[7] Surrounding infants with ice bags for induction of hypothermia for cardiac surgery has produced widespread subcutaneous panniculitis.[2]

The fat of the newborn is more highly saturated and therefore solidifies at a higher temperature than that of the adult.[8] Adams et al.[9] demonstrated the importance of this difference in vivo by feeding young pigs fats of varying saturation. This produced a corresponding difference in subcutaneous fatty acid saturation. The application of ice then caused subcutaneous panniculitis only in the group fed saturated fat. Although this is a likely explanation, no careful studies correlating an individual patient's cold susceptibility with degree of fat saturation have been done.

The physician evaluating a subcutaneous nodule should ascertain that its cause is not simply a Popsicle or an ice pack.

References

1. Haxthausen H: Adiponecrosis e frigore. Brit J Derm 53:83-89, 1941
2. Collins HA, Stahlman M, Scott HW Jr: The occurrence of subcutaneous fat necrosis in an infant following induced hypothermia used as an adjuvant in cardiac surgery. Ann Surg 138:880-885, 1953
3. Solomon LM, Beerman H: Cold panniculitis. Arch Derm (Chicago) 88:897-900, 1963
4. Rotman H: Cold panniculitis in children: adiponecrosis e frigore of Haxthausen. Arch Derm (Chicago) 94:720-721, 1966
5. Duncan WC, Freeman RG, Heaton CL: Cold panniculitis. Arch Derm (Chicago) 94:722-724, 1966
6. Lowe LB Jr: Cold panniculitis in children. Amer J Dis Child 115: 709-713, 1968
7. Lemež L: Beitrag zur Pathogenese der subcutanen Fettgewebsnekrose Neugeborener (sog. Sclerodermia neonatorum) an der Hand einer Kältereaktion des subcutanen Fettgewebes bei Neugeborenen und jungen Säuglingen. II. Mitteilung. Z. Kinderheilk 46: 323-369, 1928
8. Tedeschi CG: Pathological anatomy of adipose tissue, Handbook of Physiology: A critical, comprehensive presentation of physiological knowledge and concepts. Section 5. Adipose Tissue. Edited by AE Renold, GF Cahill Jr. Washington, DC, American Physiological Society, 1965, pp 141-168
9. Adams JE, Foster JH, Faulk WH, et al: Experimental production of subcutaneous fat necrosis by general hypothermia: relation to the chemical composition of fat. Surg Forum 5:556-563, 1954

Blood Flow, Needle Size and Hemolysis — Examining an Old Wives' Tale*

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TO avoid hemolysis during blood sampling, the admonition has been, "Use a *larger* bore needle." Theoretically, experimentally and in our clinical experience, the reverse is true. To test this hypothesis, an experimental determination of the relation between needle size and hemolysis was performed.

Methods

The blood to be examined was drawn from a dog whose stable, circulating red cells were "tagged" with ^{51}Cr (25,000 to 100,000 cpm per milliliter) as previously described.† Hemolysis was calculated from the appearance of the radioactive label in the serum or plasma.

The external jugular vein was catheterized under anesthesia with 5 cm (2 in) No. 8 Fr. polyvinyl tubing, capped with a puncturable stopper. A base-line sample was drawn slowly without a needle.

Four samples were maximally aspirated into disposable plastic 5-ml syringes through each of 25, 22 and 20-gauge, 6-cm (2½-in) needles.

Three samples of heparinized blood were delivered into centrifuge tubes through each needle (No. 25, 22 and 20). Delivery pressure was maintained constant at 150 lb per square inch (10 × atmospheric), with the use of a power injector and steel syringe.

Results

Maximal Syringe Aspiration

There was no detectable hemolysis with any needle size.

High-Pressure Delivery

Expression of blood through the 25-gauge needle led to 0.17 per cent hemolysis. This rose progressively to 8.3 and 15 per cent with larger needles (No. 22 and 20, respectively).

Discussion

Hemolysis in a needle is directly related to flow velocity and conduit radius (R). Flow rate (Poiseuille's law) is proportional to R^4. Area varies with R^2. Velocity is proportional to R^2 (flow rate/area) (R^4/R^2). Turbulence (Reynold's number) is proportional to velocity × radius (that is, R^3). Velocity and turbulence increase with larger needles under constant delivery pressure.

In other words, smaller needles have reduced areas. However, flow rate is greatly decreased, so that there is decreased velocity, turbulence and hemolysis.

Our clinical experience has been that most blood samples are smaller than 10 ml, and can be drawn with a No. 25 needle. Our data and theoretical considerations support removal of the needle, since forceful expression leads to hemolysis.

Thus, with maximal syringe aspiration, theoretical considerations indicate decreased hemolysis with smaller needles. Experimentally, no detectable hemolysis was produced by maximal aspiration of blood through No. 25, 22 or 20 needles. An increase in delivery pressure of 10 times (150 lb per square inch) produced minimal (0.17 per cent) hemolysis with the 25-gauge needle. This rose to lysis of 8.3 per cent and 15.0 per cent of the erythrocytes for 22 and 20-gauge needles, respectively.

The clinical application of these data is the use of fine-bore (such as 25-gauge) needles for blood sampling, without fear of hemolysis. The needle should be removed to empty the syringe.

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†Moss G: Improved experimental red cell mass measurement. Surgery 66:771, 1969

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