

# Research

## Intramuscular gluteal injections in the increasingly obese population: retrospective study

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### Abstract

**Aims** To examine depth of subcutaneous fat at gluteal intramuscular injection sites.

**Design** Retrospective study.

**Setting** General hospital.

**Participants** 100 consecutive adults who had computed tomography of the pelvis.

**Main outcome measures** Minimum distance between the surface of the skin and the nearest edge of muscle at intramuscular injection sites.

**Results** 12 patients had a ventrogluteal site depth of more than 35 mm, the maximum depth of a green needle, and 26 had a ventrogluteal depth of more than 25 mm, the maximum depth of a blue needle. 43 patients had a dorsogluteal site depth of more than 35 mm, and 72 had a dorsogluteal depth of more than 25 mm. The intramuscular site was likely to be deeper in women.

**Conclusion** Standard green and blue needles do not reach the gluteal muscles in a considerable number of patients.

### Introduction

Studies of intramuscular injections have shown differences in peak plasma concentrations of narcotics and in perceived pain relief, depending on gluteal or deltoid injection site.<sup>1</sup> Response levels to vaccination vary according to intramuscular injection site.<sup>2</sup> Different responses depending on site have also been noticed for injections of antibiotics,<sup>3</sup> insulin, and lignocaine.<sup>4</sup>

Possible reasons for this variation in efficacy include different ratios of adipose to lean muscle tissue, greater blood flow in deltoid than gluteal muscle,<sup>5</sup> and positional external compression of the gluteus. In a population that is increasingly overweight, these factors could become more exaggerated, leading overall to less effective intramuscular gluteal injections. Additionally, if the depth of fat is so great that the needle cannot reach the muscular layer in many patients, the average absorption of the drug in the population will be lower.

### Method

Scans from 100 consecutive adults (39 men, 61 women; mean 47.8 (SD 11.3) years; range 22-65 years) who had computed tomography scans of the pelvis were included in the study. I used automated computed tomography callipers to determine the minimum distance between the surface of the skin and the nearest edge of muscle at the ventrogluteal and dorsogluteal injection sites. (To determine the ventrogluteal site, place the ball of the opposing hand on the greater trochanter and index finger

on the anterior superior iliac crest; form a V with the middle finger; the injection site is within the V.<sup>6</sup> The dorsogluteal site is the upper outer quadrant of the buttock.<sup>7</sup>) I also correlated the depth at both sites with age and sex of the patients.

### Results

The depth of adipose tissue at the ventrogluteal site ranged from 2.5 mm to 62.6 mm (mean 19.0 (12.8) mm). In 12 patients the depth was more than 35 mm, the extent of a green needle, and in 26 the depth was more than 25 mm, the extent of a blue needle. The depth at the dorsogluteal site ranged from 7.5 mm to 59.8 mm (mean 32.0 (10.5) mm). In 43 patients the depth was more than 35 mm, and in 72 the depth was more than 25 mm.

Age was not correlated with dorsogluteal depth, but increasing age was related to increasing ventrogluteal depth ( $P < 0.01$ , Pearson's correlation coefficient).

Site depth was markedly different in men and women. In the ventrogluteal site, 10 of 69 (16%) women had a depth of  $> 35$  mm and 22 (36%) a depth of  $> 25$  mm, whereas 2 of 39 (5%) men had a depth of  $> 35$  mm and 4 (10%) of  $> 25$  mm. In the dorsogluteal site, 35 (57%) women had a depth of  $> 35$  mm and 55 (90%) of  $> 25$  mm, whereas 8 (21%) men had a depth of  $> 35$  mm and 17 (44%) of  $> 25$  mm. All differences between men and women were significant ( $P < 0.01$ ,  $\chi^2$  test, except  $P < 0.05$  for ventrogluteal depth  $> 35$  mm).

### Discussion

Due to the depth of fat, intramuscular injections with large (green) needles into the anterior gluteal site in this sample would be subcutaneous in 12% of patients (16% of women and 5% of men), and for injections with smaller (blue) needles in 26% (36% of women and 10% of men). In the posterior gluteal site, large needles will fail to reach muscle in 43% (57% of women and 21% of men), and small needles will fail in 72% (90% of women and 44% of men).

The number of patients used in this study was small, and they were recruited only from a local population and did not include the extremes of age. Although the depth of their gluteal intramuscular injection sites may vary from the national average, this study shows that in a significant minority of patients the standard green or blue needles, which are the normal method of delivery, will fail to reach muscle. In highly obese populations, the depth could be expected to be even greater than that shown here.

As previous studies have shown low efficacy of gluteal intramuscular injections, this route should be avoided for most drugs.

If alternative routes are not possible, using longer needles should be considered.

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Ethical approval: Not required.

### What is already known on this topic

The gluteal site can be less effective for intramuscular injections than other sites, such as deltoid

### What this study adds

The gluteal muscles are beyond the reach of standard green and blue needles in a significant minority of patients

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