

## **Questioning the anatomical relationship between the seventh thoracic vertebra and the inferior angle of scapula: a radiographic review to inform anaesthesia practice**

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### **Abstract**

#### *Aim*

Blockade of thoracic dermatomes for anaesthesia and analgesia relies on accurate identification of spinal level. For many practitioners this is achieved by using the classical relationship between the inferior angle of scapula (IAS) and the spinous process of the seventh thoracic vertebra. There is mounting published evidence to suggest that this relationship is not a reliable one.

#### *Methods*

100 departmental radiographs in posterior-anterior projection were reviewed by a radiologist. Exclusion criteria included age  $\leq 20$  years and spinal pathology.

#### *Results*

We found that the T7-IAS relationship was not a reliable one, and that anatomical variation exists as a function of age and gender. T8 is the most frequent level corresponding to the IAS in the study population and in males, with the T8/9 interspace the most frequent in females. The T7/8 interspace is the most frequent in the third decade descending to T8/9 in the seventh.

#### *Discussion*

For accurate identification of the correct vertebral level we suggest techniques such as ultrasound or fluoroscopic guidance rather than clinical examination and historical anatomical associations.

## Introduction

Thoracic epidural is an established method for providing anaesthesia and analgesia for the thoracic surgery and chest trauma. However, non-neuraxial truncal anaesthesia techniques (eg. Paravertebral block and Erector Spinae Plane block) are enjoying increasing popularity. Both of these approaches rely on accurate identification of spinal level for both safety and an adequate therapeutic result. The inferior angle of scapula (IAS) has traditionally been used for this purpose, due to its classical landmark relationship with seventh thoracic vertebral process<sup>1</sup>. Previous radiographic and ultrasound studies suggest that this relationship is unreliable<sup>2,3</sup>, however there is no radiographic study in the literature with radiographs assessed by physician radiologist.

We hypothesised that normal anatomical variation will likely undermine this classical anatomical association, and set out to determine in what proportion of “normal” adults demonstrate this classical finding.

## Methods

50 male and 50 female departmental chest films, acquired in posterior-anterior projection were retrospectively reviewed by a senior resident in radiology, and approved by a Consultant Radiologist. Exclusion criteria included: age <20; and spinal pathology resulting in contralateral discrepancies of scapular position (scoliosis). The “hugging” position maintained by each subject while image is obtained was assumed as a surrogate for the position required for truncal blockade.

Informed consent of each subject not required, as no identifiable data recorded.

For analysis, each evaluated spinal level was subdivided into two regions: vertebral body and intervertebral space.

Data were analysed using descriptive statistics including frequency, percentage and standard deviation, using Microsoft Excel<sup>4</sup>. Spinal levels were coded to facilitate statistical analysis with 1 representing T6 body, 2 the T6/7 interspace, and so on, continuing in sequence to the lower T10 body.

## Results

Mean age (SD) for all studies was 55.5 (17.6), with the mean age of male patients 53.2 (17.0) and female 57.9 (18.1).

T8 was the most frequent level corresponding to the line connecting both inferior angles of scapula. However, significant variation existed, from T6/7 interspace to T10 spinous process.

The relationship changed with age and gender. T8 was the most frequent corresponding level in males with the T8/9 interspace the most frequent in women. The most frequent level was T7/8 interspace in third decade (n=3), T8 spinous process in the fourth (n=5), fifth (n=5) and sixth (n=9) decade and T8/9 interspace in the seventh (n=7) and eighth (n=5) decade. The mode in the male group was T8 (n=32) while in the female group it was the T8/9 (n=30) interspace.

*Table 1. Spinal levels corresponding to the inferior angle of scapula*

	% Total (n)	of Mode	T6/7 %(n)	T7 %(n)	T7/8 %(n)	T8 %(n)	T8/9 %(n)	T9 %(n)	T9/10 %(n)	T10 %(n)
<b>Total</b>	100	T8	3	12	21	30	26	5	2	1
						32				
<b>Male</b>	50	T8	4 (2)	8 (4)	28 (14)	(16)	22 (11)	2 (1)	2 (1)	2 (1)
						28				
<b>Female</b>	50	T8/9	2 (1)	16 (8)	14 (7)	(14)	30 (15)	8 (4)	2 (1)	0
<b>Age 20-29</b>	7	T7/8	0	14 (1)	43 (3)	29 (2)	14 (1)	0	0	0
<b>Age 30-39</b>	13	T8	0	23 (3)	23 (3)	38 (5)	8 (1)	8 (1)	0	0
<b>Age 40-49</b>	17	T8	0	18 (3)	18 (3)	29 (5)	24 (4)	6 (1)	6	0
<b>Age 50-59</b>	19	T8	5 (1)	11 (2)	11 (2)	47 (9)	26 (5)	0	0	0
<b>Age 60-69</b>	21	T8/9	10 (2)	14 (3)	19 (4)	10 (2)	33 (7)	10 (2)	5	0
<b>Age 70-79</b>	10	T8/9	0	0	40 (4)	0	50 (5)	10 (1)	0	0
<b>Age 80-89</b>	13	T8	0	0	15 (2)	54 (7)	23 (3)	0	0	8 (1)

Our review indicates that the landmark relationship between the IAS and T7 vertebra is not a reliable one. There is variation with respect to both age and gender. The findings from our study population indicate that the association between spinal level and IAS descends from higher to lower with age; and is higher in males than females.

We accept some limitations limitation of this study: its retrospective nature introduces the possibility of selection bias. This also limited demographic information we could gather beyond age and gender (e.g. Body Mass Index). A multi-centre study would certainly be more generalisable but was beyond the scope of this initial review. While the “hugging position” used as proxy is not an exact surrogate for specific neuraxial and truncal interventions, it does provide consistency in our study which aimed to identify scapular position in a large population.

In conclusion, for accurate placement of both neuraxial and non-neuraxial truncal blocks we recommend adjunct techniques such as ultrasound or fluoroscopic guidance, rather than clinical examination and historical anatomical associations.

**Declarations of Conflicts of Interest:**

None declared.

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**References:**

1. Butterworth IV JF, Mackey DC, Wasnick JD. Spinal, Epidural, & Caudal Blocks. In: Morgan & Mikhail's Clinical Anesthesiology, 6e [Internet]. New York, NY: McGraw-Hill Education; 2018 [cited 2023 Jul 31]. Available from: [accessanesthesiology.mhmedical.com/content.aspx?aid=1161431915](https://accessanesthesiology.mhmedical.com/content.aspx?aid=1161431915)
2. Coyne JM, Conlon N. The seventh thoracic vertebral level is more reliably identified by point of care ultrasound than by palpation of the inferior angle of the scapula. *European Journal of Anaesthesiology*. 2020 Sep;37(9):826–7.
3. Haneline MT, Cooperstein R, Young MD, Ross J. Determining spinal level using the inferior angle of the scapula as a reference landmark: a retrospective analysis of 50 radiographs. *J Can Chiropr Assoc*. 2008 Mar;52(1):24–9.
4. Microsoft Corporation. Microsoft Excel [Internet]. 2019. Available from: <https://office.microsoft.com/excel>.