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Abbreviations and Symbols

In the text the following abbreviations and symbols are used:

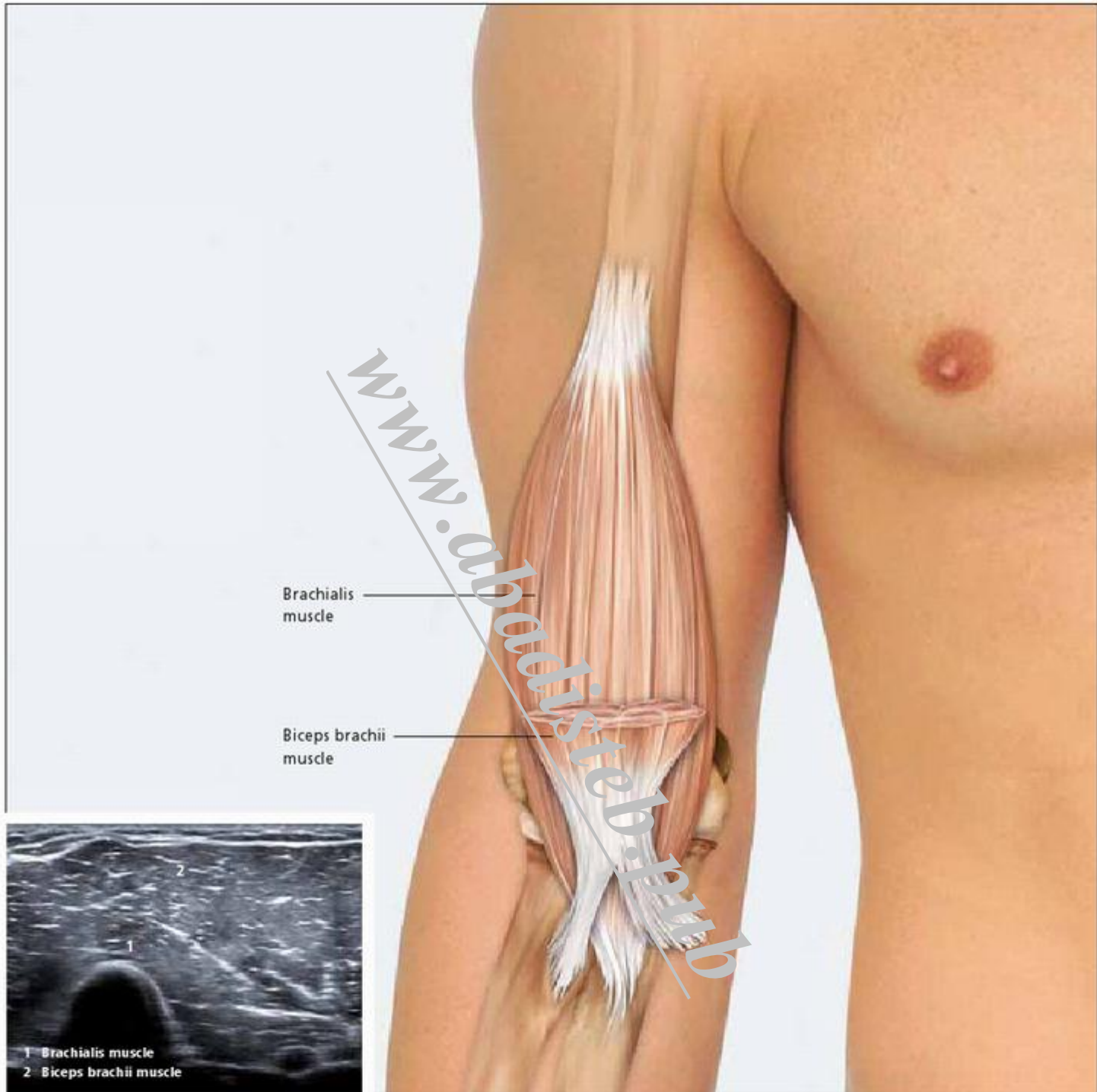
Vertebral column:	C	cervical spine
	T	thoracic spine
	L	lumbar spine
	S	sacral spine

Other:	A.	Artery
	Aa.	Arteries
	AL	Anterior axillary line
	BoNT	Botulinum Neurotoxin
	CT	Computed tomography
	EMG	Electromyography
	LV	Lumbar vertebrae
	M.	Muscle
	Mm.	Muscles
	MCL	Midclavicular line
	MCPJ	Metacarpophalangeal joint
	ML	Median line
	MU	Mouse Unit
	N.	Nerve
	Nn.	Nerves
	V.	Vein
Vv.	Veins	

	direction of movement
	auxiliary line as described in text
	site of injection
	point of orientation

Brachialis muscle

2



Nerve supply

Musculocutaneous nerve, C5–C7

Radial nerve, C5–C6

Origin

Distal two thirds of the anterior shaft of humerus

Intermuscular septum between brachialis and triceps brachii

Insertion

Ulnar tuberosity

Coronoid process of ulna

Dosage/Needle size

Xeomin*: 20–60 MU (rarely higher)

Botox*: 20–60 MU (rarely higher)

Dysport*: 60–200 MU (rarely higher)

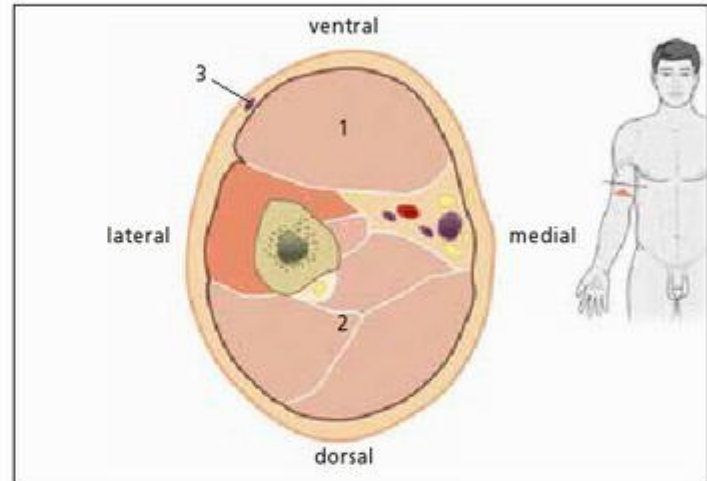
Injection sites: 1–2

Needle length: 40 mm / 27 gauge



Action

The brachialis is the most powerful flexor of the elbow. It has no influence on the radioulnar joint due to its sole insertion onto ulna. Muscle action is tested with the elbow flexed and supinated. Being a uni-articulate muscle its function is easier to assess compared to that of biceps brachii.



Topographical indication

Erroneous injection into the biceps brachii (1) can be avoided by moving it medially. By injecting too far posteriorly the injection or diffusion of the drug may reach the triceps brachii (2). Theoretically, the cephalic vein (3), which lies anterolaterally and is usually clearly visible, could be injured.



Injection protocol

Number of puncture sites: 1–2, depending on dosage and indication; mostly 1 site.

The regions of motor end plates are relatively centred.



Injection technique

Injection site: 3–4 cm proximal to the elbow fold and lateral to the tendon of the biceps with the injection depth depending on the thickness of the muscle.

Injection direction: vertical or in the direction of the fibres

Patient position: sitting or supine with the elbow slightly flexed

Clinical application

The brachialis should also usually be treated in cases of flexor spasticity. In practice, attention is usually unjustifiably only paid to the biceps brachii. In too early secondary injection, meaning that the drug's effect has not completely worn off, puncture is difficult because the muscle cannot be palpated.

The total amount injected is restricted, thus in cases of extreme flexor spasticity a sufficient dosage cannot be given. Instead the desired total dosage must be distributed respectively among all elbow flexors. Due to the stabilizing influence of the brachialis on the elbow joint, the recommended dosage to the brachialis should not be exceeded.

Flexor digiti minimi brevis muscle of the foot

3



Nerve supply

Lateral plantar nerve, S2–S3

Origin

Base of 5th metatarsal, sheath of peroneus longus tendon, long plantar ligament

Insertion

Lateral side of base of proximal phalanx of 5th toe

Dosage/Needle size

Xeomin*: 5–20 MU

Botox*: 5–20 MU

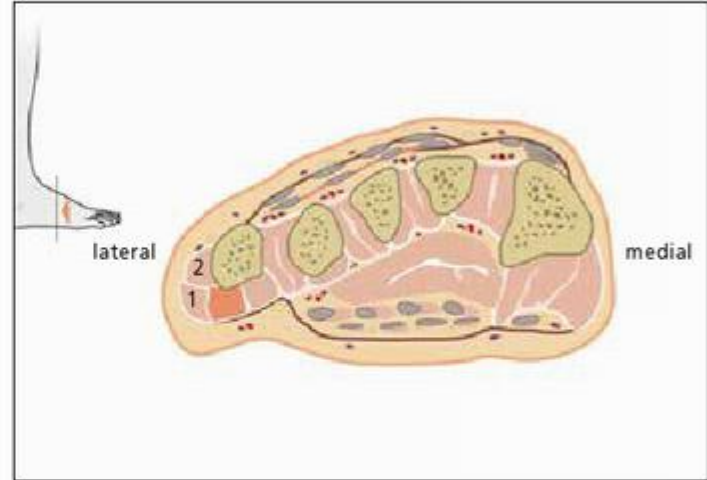
Dysport*: 20–80 MU

Injection sites: 1

Needle length: 20 mm / 30 gauge



Action
The flexor digiti minimi brevis flexes the 5th toe and supports the arch of the foot.



Topographical indication
By injecting too far laterally, the abductor digiti minimi (1) or the opponens digiti minimi (2) can be infiltrated. Penetrate to the bone and then retract slightly.



Injection protocol
Number of puncture sites: 1 site



Injection technique
Injection site: 2 cm proximal to the head of the 5th metatarsal
Injection depth: 5–10 mm, depending on the thickness of the muscle.
Penetrate to the bone and then retract slightly.
Patient position: prone

Clinical application

Flexion in the metatarsophalangeal joint is carried out mutually by the flexor digiti minimi brevis, the flexor digitorum longus and the flexor digitorum brevis. Injection is rarely required.

Splenius cervicis muscle

5



Nerve supply

Posterior branches of spinal nerves C5–C7

Origin

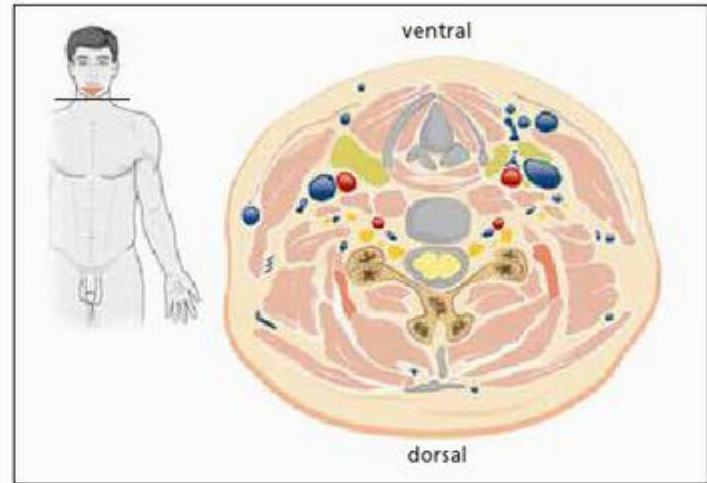
Spinous processes of thoracic vertebrae 3–5 (6)

Insertion

Transverse processes of cervical vertebrae 1–2 (3)

Dosage/Needle size

Xeomin*: 20–60 MU (rarely higher)
 Botox*: 20–60 MU (rarely higher)
 Dysport*: 80–200 MU (rarely higher)
 Injection sites: 1–2
 Needle length: 40 mm / 27 gauge

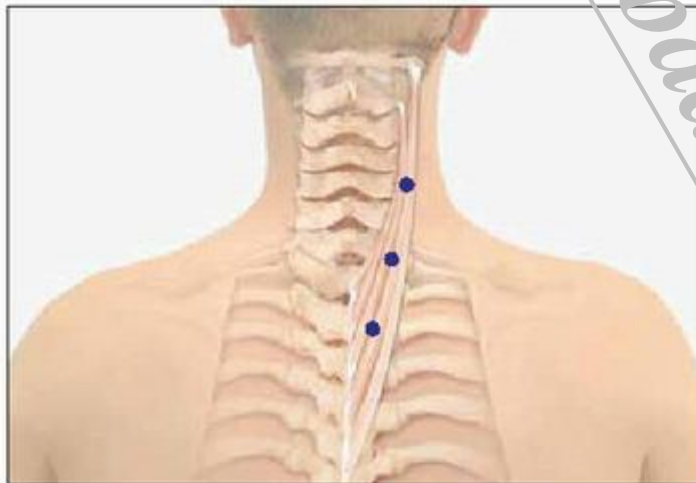


Action

When it contracts unilaterally, the splenius cervicis inclines and rotates the cervical spine to the same side. When contracting on both sides, it extends the cervical spine.

Topographical indication

In its distal region, the splenius cervicis is located distally and laterally of the splenius capitis muscle. In the cranial region, however, the former lies below the latter; i.e., the splenius cervicis winds around the splenius capitis slightly.



Injection protocol

Number of puncture sites: 1–3, usually only 1–2 sites

Injection technique

The splenius cervicis is often difficult to distinguish from the splenius capitis. A safe place to inject is distally of the 3rd thoracic vertebra. At the level of the 5th cervical vertebra, the splenius cervicis is located mostly laterally of the splenius capitis, and below it at the level of the 3rd cervical vertebrae.

Clinical application

In most cases, this muscle tends to be injected inadvertently; if injected intentionally, it is most likely to be for the treatment of retrocollis.

Levator palpebrae superioris muscle



7

Nerve supply

Superior branch of the oculomotor nerve

Origin

Inferior surface of lesser wing of sphenoid bone

Optical canal

Insertion

Cartilage and skin of upper eyelid

Dosage/Needle size

Xeomin*: 10–20 MU (rarely higher)

Botox*: 10–20 MU (rarely higher)

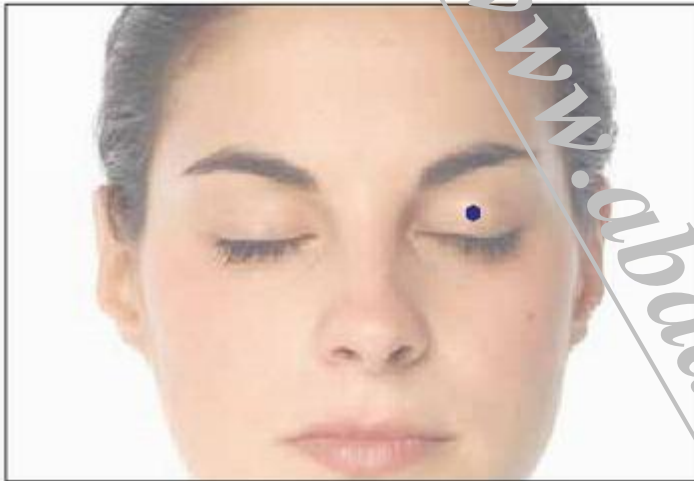
Dysport*: 40–80 MU (rarely higher)

Injection sites: 1

Needle length: 10–20 mm / 27–30 gauge

**Action**

The levator palpebrae superioris raises the upper eyelid and thereby adjusts the opening of the palpebral fissure. It is also involved in blinking. The superior and inferior tarsus regulate the refraction of the upper and lower eyelids by way of the sympathetic nervous system.

**Topographical indication**

The injection must be superficial, otherwise there is a risk of penetrating the upper eyelid, with the eyeball lying directly beneath. Injecting too superficially, however, bears the risk of paralyzing the palpebral part of the orbicularis oculii and diffusion of the BoNT into the lacrimal gland.

Injection protocol

The injection is undertaken in the middle of the upper eyelid at the crease between the tarsal and supratarsal parts of the upper eyelid (superior palpebral sulcus).

**Injection technique**

Most users recommend injecting subcutaneously immediately below the middle of the upper orbital margin. Alternatively, as illustrated here, the injection can be placed in the middle of the superior palpebral sulcus after forming a small fold of skin between two fingers. It is also recommended, to avoid the complications enumerated above, to inject parallel to the eyeball (not shown here).

Patient position: supine

Clinical application

Usually an attempt is made not to paralyse the levator palpebrae superioris (e.g. in cases of blepharospasm). An attempt at inducing an intentional protective ptosis is carried out in patients with therapy-resistant corneal erosion and ulceration. Levator palpebrae superioris is permanently active during waking, except when the eyes are shut. Due to its nerve supply and derivation, the levator palpebrae superioris belongs to the muscles of the orbit.