TABLE 11.5 • **Muscles of the thorax**

Muscle	Origin	Insertion	Action	Innervation
Diaphragm	Circumference of thoracic inlet from xiphoid process, costal cartilages of ribs 6-12, and lumbar vertebrae	Central tendon of diaphragm	Depresses and draws central tendon forward in inhalation, reduces pressure in thoracic cavity, and increases pressure in abdominal cavity	Phrenic nerve (C3-C5)
Internal intercostals	Longitudinal ridge on inner surface of ribs and costal cartilages	Superior border of next rib below	Elevate costal cartilages of ribs 1-4 during inhalation, depress all ribs in exhalation	Intercostal branches of T1-T11
External intercostals	Inferior border of ribs	Superior border of next rib below	Elevate ribs	Intercostal branches of T1-T11
Levator costarum	Ends of transverse processes of C7, T2-T12	Outer surface of angle of next rib below origin	Elevates ribs, lateral flexion of thoracic spine	Intercostal nerves
Subcostales	Inner surface of each rib near its angle	Medially on the inner surface of second or third rib below	Draws the ventral part of the ribs downward, decreasing the volume of the thoracic cavity	Intercostal nerves
Scalenus anterior	Transverse processes of C3-C6	Inner border and upper surface of first rib	lateral flexion, and contralateral rotation of cervical spine	Ventral rami of C5, C6, sometimes C4
Scalenus medius	Transverse processes of C2-C7	Superior surface of first rib	Elevates first rib, flexion, lateral flexion, and contralateral rotation of cervical spine	Ventral rami of C3-C8
Scalenus posterior	Transverse processes of C5-C7	Outer surface of second rib	Elevates second rib, flexion, lateral flexion, and slight contralateral rotation of cervical spine	Ventral rami of C6-C8
Serratus posterior (superior)	Ligamentum nuchae, spinous processes of C7, T1, and T2 or T3	Superior borders lateral to angles of ribs 2-5	Elevates upper ribs	Branches from anterior primary rami of T1-T4
Serratus posterior (inferior)	Spinous processes of T10-T12 and L1-L3	Inferior borders lateral to angles of ribs 9-12	Counteracts inward pull of diaphragm by drawing last four ribs outward and downward	Branches from anterior primary rami of T9-T12
Transversus thoracis	Inner surface of sternum and xiphoid process, sternal ends of costal cartilages of ribs 3-6	Inner surfaces and inferior borders of costal cartilages 3-6	Depresses ribs	Intercostal branches of T3-T6

Erector spinae muscles* (sacrospinalis) FIGS. 11.17, 11.18, 11.19

(e-rek´tor spi´ne) (sa´kro-spi-na´lis)

Iliocostalis

(il´i-o-kos-ta´lis): lateral layer

Longissimus

(lon-jis´i-mus): middle layer

Spinalis

(spi-na´lis): medial layer

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*This muscle group includes the iliocostalis, the longissimus dorsi, the spinalis dorsi, and divisions of these muscles in the lumbar, thoracic, and cervical sections of the spinal column.

Origin

Iliocostalis: medial iliac crest, thoracolumbar aponeurosis from sacrum, posterior ribs 3-12

Longissimus: medial iliac crest, thoracolumbar aponeurosis from sacrum, lumbar 1-5 transverse processes and thoracic 1-5 transverse processes, cervical 5–7 articular processes

Spinalis: ligamentum nuchae, seventh cervical spinous process, thoracic 11 and 12 spinous processes, and lumbar 1 and 2 spinous processes

Insertion

Iliocostalis: posterior ribs 1-12, cervical 4-7 transverse processes

Longissimus: cervical 2-6 spinous processes, thoracic 1-12 transverse processes, lower nine ribs, mastoid process

Spinalis: second cervical spinous process, thoracic 5–12 spinous processes, occipital bone

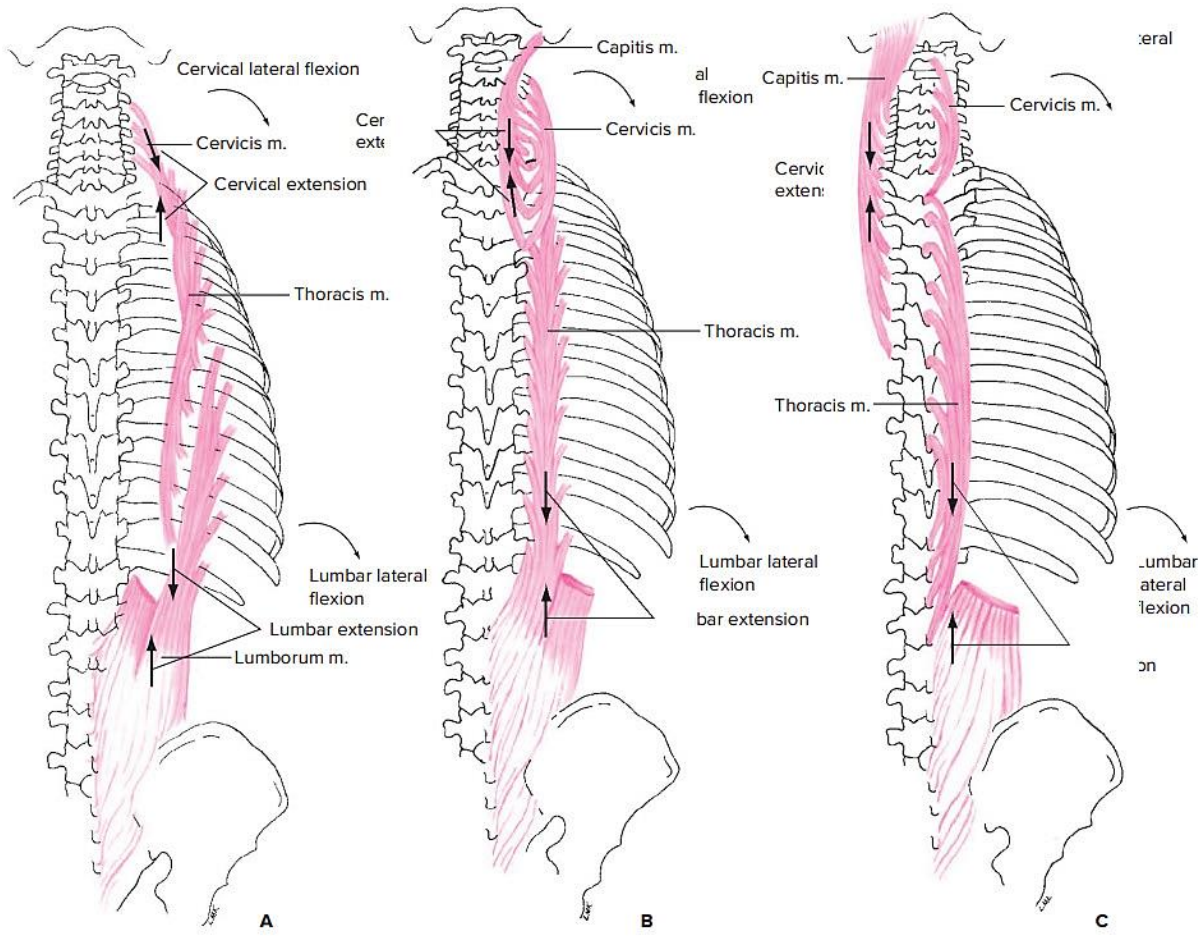

FIG. 11.18 • Erector spinae (sacrospinalis) muscle, posterior view. **A**, Iliocostalis lumborum, thoracis, and cervicis; **B**, Longissimus thoracis, cervicis, and capitis; **C**, Spinalis thoracis, cervicis, and capitis.

Action

Extension, lateral flexion, and ipsilateral rotation of the spine and head

Anterior pelvic rotation

Lateral pelvic rotation to contralateral side

Palpation

Deep and difficult to distinguish from other muscles in the cervical and thoracic regions; with subject prone, palpate immediately lateral to spinous processes in lumbar region with active extension, resistance against rotation may further assist in palpation for ipsilateral muscles

Innervation

Posterior branches of the spinal nerves

Application, strengthening, and flexibility

The erector spinae muscles function best when the pelvis is posteriorly rotated. This lowers the origin of the erector spinae and makes it more effective in keeping the spine straight. As the spine is held straight, the ribs are raised, thus fixing the chest high and consequently making the abdominal muscles more effective in holding the pelvis up in front and flattening the abdominal wall.

An exercise known as the dead lift, employing a barbell, uses the erector spinae in extending the spine. In this exercise, the subject bends over, keeping the arms and legs straight; picks up the barbell; and returns to a standing position. In performing this type of exercise, it is very important to always use correct technique to avoid back injuries. Voluntary static contraction of the erector spinae in the standing position can provide a mild exercise and improve body posture.

The erector spinae and the various divisions may be strengthened through numerous forms of back extension exercises. These are usually done in a prone or face-down position in which the spine is already in some state of flexion. The subject then uses these muscles to move part or all of the spine toward extension against gravity. A weight may be held in the hands behind the head to increase resistance. Seated trunk twists assist as well, especially with the iliocostalis and longissimus.

Maximal hyperflexion of the entire spine stretches the erector spinae muscle group. Stretch may be isolated to specific segments through specific movements. Maximal flexion of the head and cervical spine stretches the capitis and cervicis segments. Flexion combined with lateral flexion to one side accentuates the stretch on the contralateral side. Thoracic and lumbar flexion places the stretch primarily on the thoracis and lumborum segments.

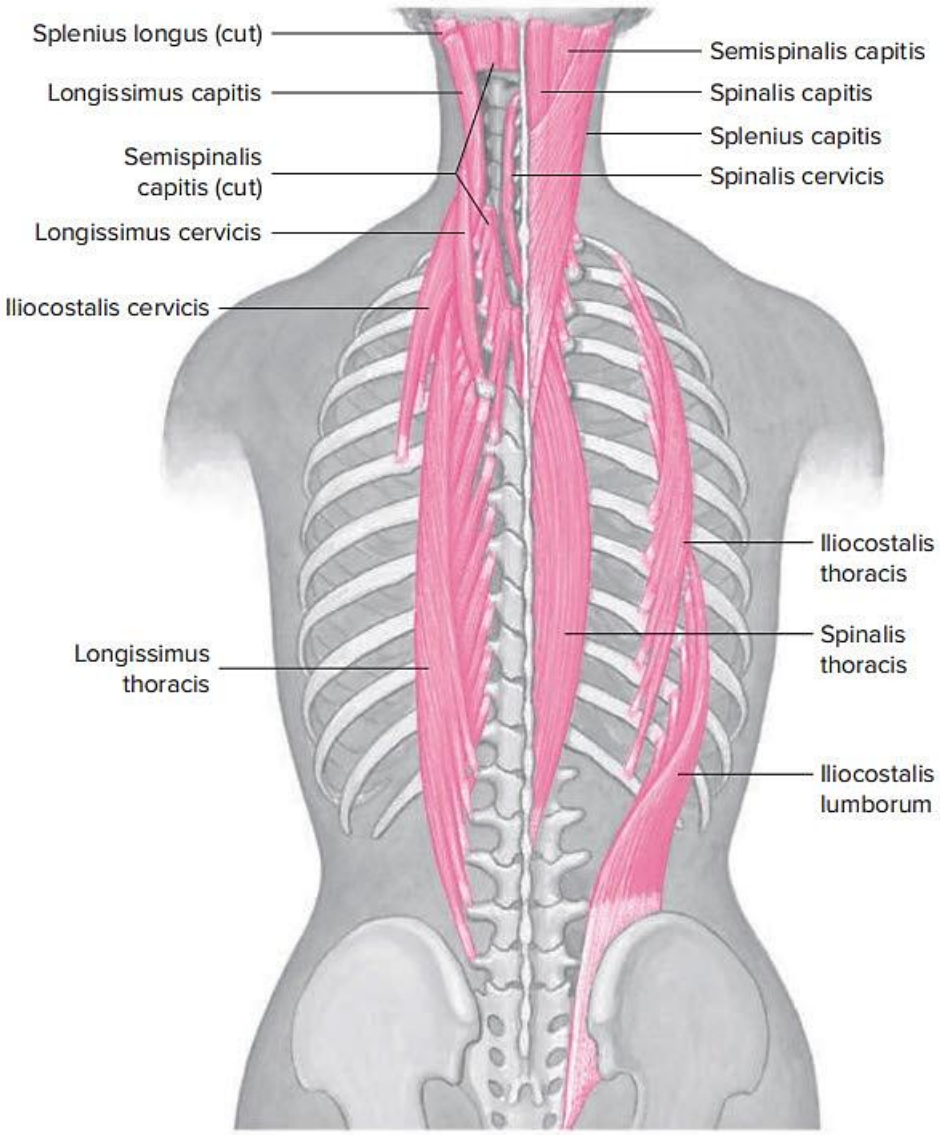

FIG. 11.19 • Muscles of the back and the neck help move the head (posterior view) and hold the torso erect. The splenius capitis and semispinalis have been cut on the left to show underlying muscles.

Quadratus lumborum muscle FIG. 11.20

(kwad-ra´tus lum-bo´rum)

Origin

Posterior inner lip of the iliac crest

Insertion

Approximately one-half the length of the lower border of the twelfth rib and the transverse process of the upper four lumbar vertebrae

Action

Lateral flexion to the ipsilateral side

Stabilizes the pelvis and lumbar spine

Extension of the lumbar spine

Anterior pelvic rotation

Lateral pelvic rotation to contralateral side

Palpation

With subject prone, just superior to iliac crest and lateral to lumbar erector spinae with isometric lateral flexion

Innervation

Branches of T12, L1 nerves

Application, strengthening, and flexibility

The quadratus lumborum is important in lumbar lateral flexion and in elevating the pelvis on the same side in the standing position. Trunk rotation and lateral flexion movements against resistance are good exercises for development of this muscle. The position of the body relative to gravity may be changed to increase resistance on this and other trunk and abdominal muscles. Left lumbar lateral flexion while in lumbar flexion stretches the right quadratus lumborum, and vice versa.

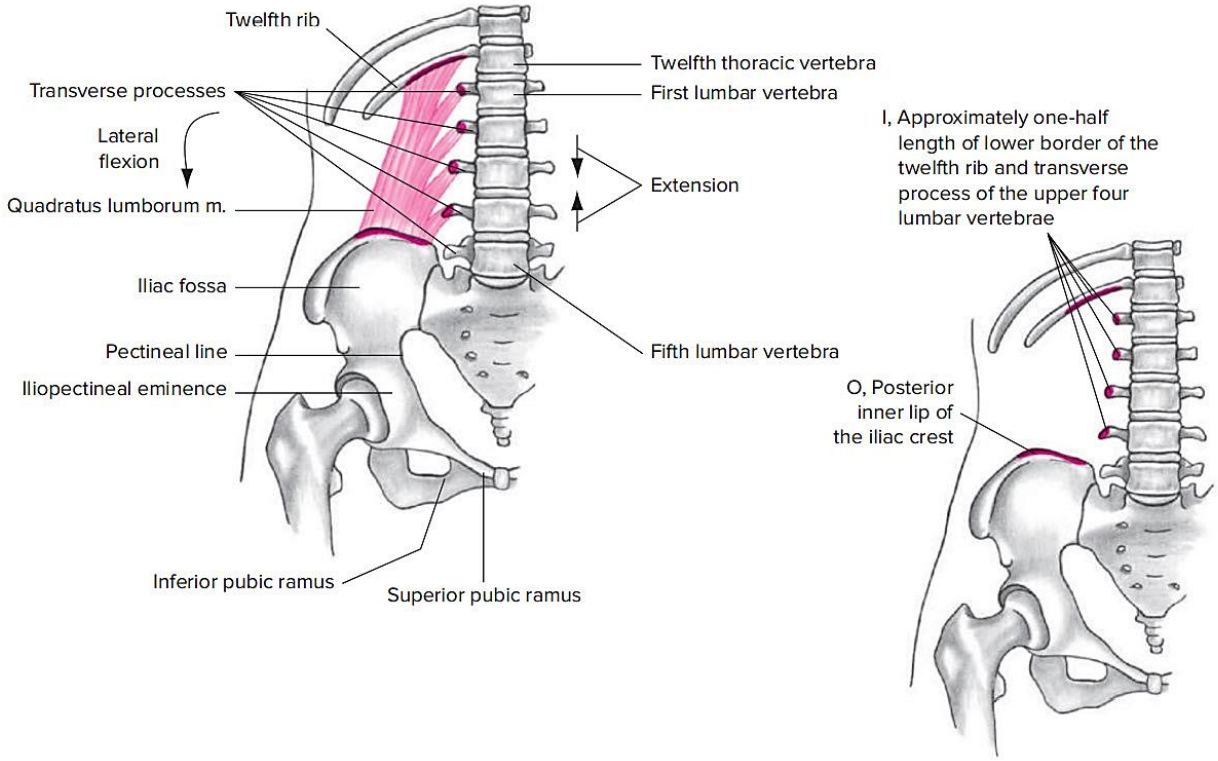

FIG. 11.20 • Quadratus lumborum muscle. O, Origin; I, Insertion.

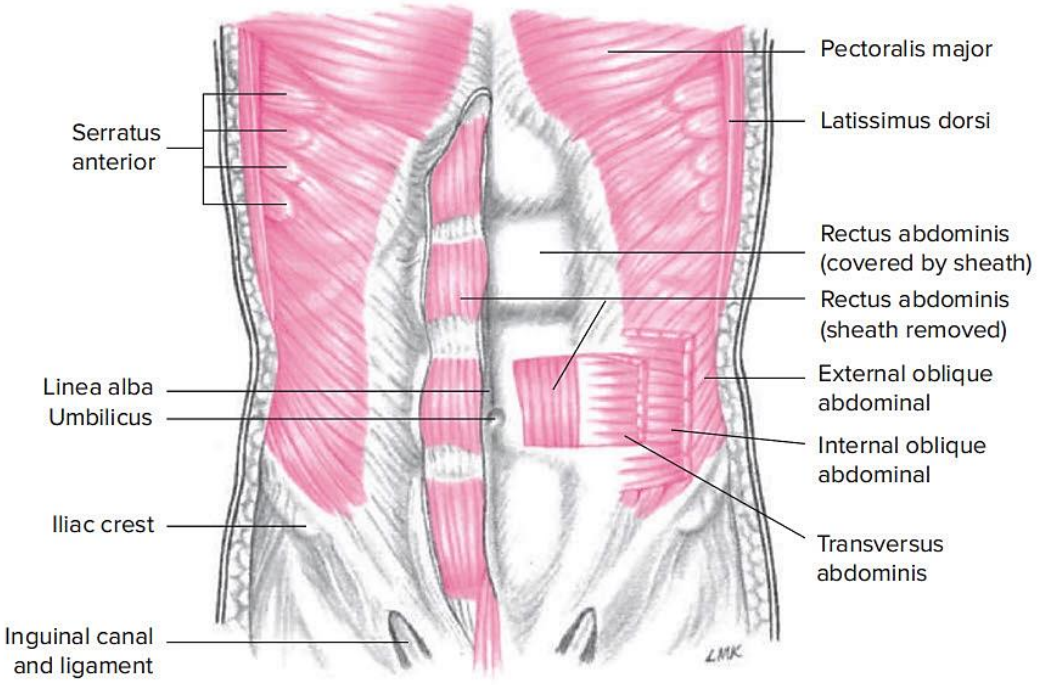

FIG. 11.21 • Muscles of the abdomen: external oblique and rectus abdominis. The fibrous sheath around the rectus has been removed on the right side to show the muscle within.

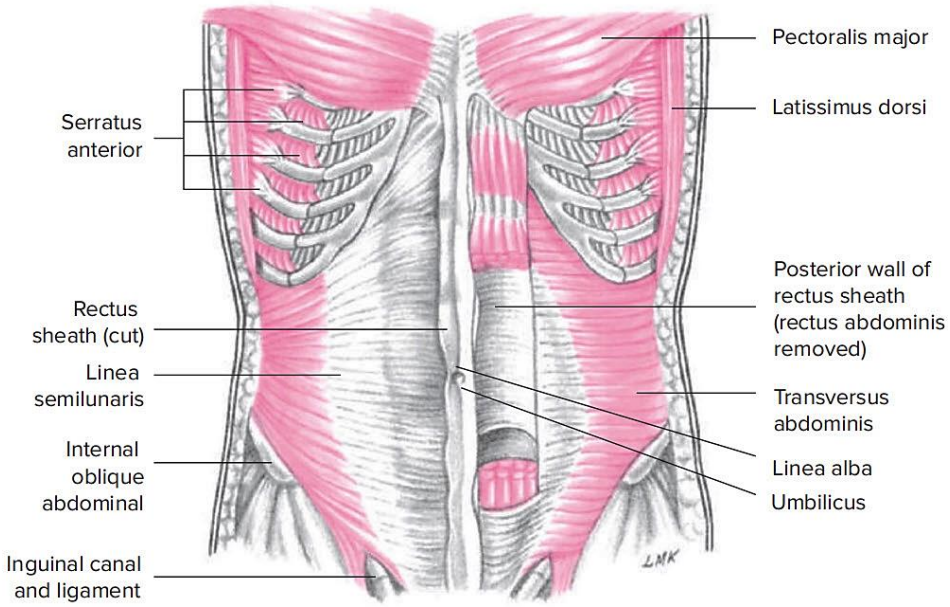

FIG. 11.22 • Muscles of the abdomen. The external oblique has been removed on the right side to reveal the internal oblique. The external and internal obliques have been removed on the left side to reveal the transversus abdominis. The rectus abdominis has been cut to reveal the posterior rectus sheath.

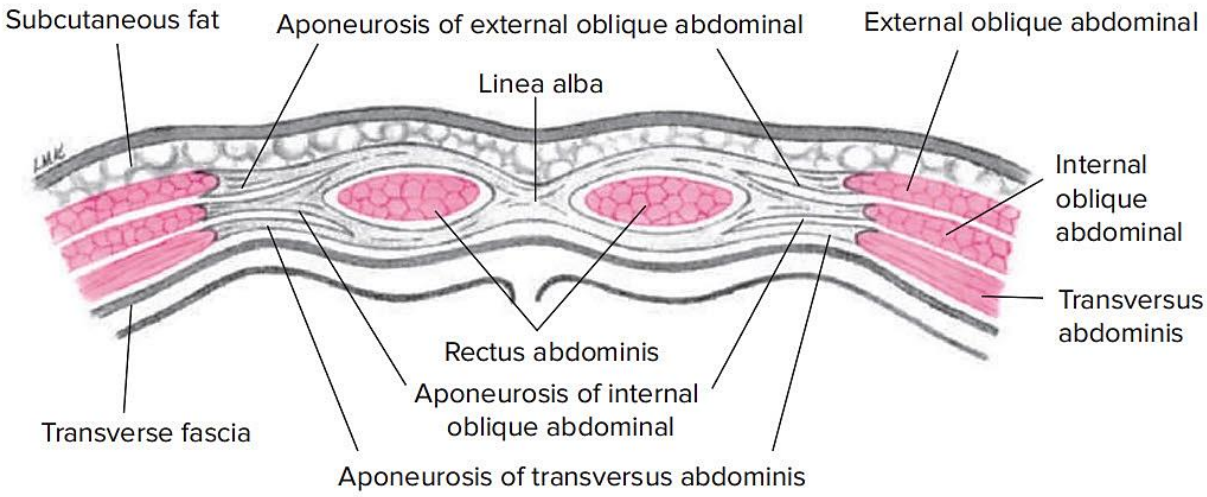

FIG. 11.23 • Abdominal wall above umbilicus. The unique arrangement of the four abdominal muscles with their fascial attachment in and around the rectus abdominis muscle is shown. With no bones for attachments, these muscles can be adequately maintained through exercise.

Lumbar flexion

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Lumbar lateral flexion

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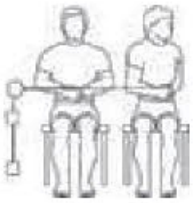

Lumbar rotation unilaterally

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