Charles University

Faculty of Physical Education and Sport

Cervicobrachial Syndrome

Bachelor Thesis

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Author: Silje Solbakken Syversen

Supervisor: Mgr. Agnieszka Dudová, Ph.D.

Abstract

Title:

EN: Cervicobrachial Syndrome

CZ: Cervikobrachiální Syndrom

Thesis aim:

This thesis discusses the rehabilitation of CB syndrome. It is discussed in a theoretical and a practical part, in which the practical part is emphasized. The theoretical part aims to describe the anatomical, kinesiological and biomechanical properties of the C-spine in addition to the disease. The practical part concerns a man in the age of 68 in the state of 5 weeks after first symptom of CB syndrome. The practical part aims to describe examination, therapy implementation and conclusion in relation to the given diagnosis.

Methods:

McKenzie mthod, soft tissue technique, PNF and breathing are some of the methods which were implemented. 5 therapy sessions were completed.

Result:

Patient showed a markedly increase in range of extension in the neck. Result of extension was 35°, and only slight pain in the end range of the movement. On the pain scale he went from 10 till 2. Other results was increase of muscle strength in triceps and anconeus (4→5), less restricted soft tissues in neck, better breathing pattern and improvement of posture.

Conclusion:

According the findings in initial examination improvements were expected as the therapy application started. He showed satisfying recovery and reached a functional level that he can live a normal lifestyle with. He has a good prognosis with his present functional activity level.

Keywords:

Cervical spine, cervicobrachial syndrome, cervical rehabilitation

Declaration

I hereby declare that this work is entirely my own, individual work based on knowledge from books, articles, journals and by attending seminars and lectures at FTVS.

I also declare that no invasive methods were used during the practical approach and that the patient was fully aware of the procedures at any given time.

Prague, April 2013

Acknowledgement

I would like to thank my boyfriend and family for all their love and support during my 3 years in Prague. This support is what keeps me going and could not be appreciated enough. I would also give my appreciation to my fellow classmates and friends, the stay in Prague would not have been the same without them

I would also like to thank Mgr. Markéta Ptáčková for guiding me through the whole practical process with this thesis and giving me valuable advices and knowledge.

And most importantly I have to show my gratitude towards Mgr. Agnieszka Dudová Ph.D. She has guided me through the entire process of this bachelor thesis. Her careful supervision is very much appreciated.

Thank you all!

Silje Solbakken Syversen

Prague, April 2013

Table of content

1 Introduction

This thesis concerns theoretical and practical aspect of the diagnosis cervicobrachial syndrome. It is an unspecific diagnosis in which the patient complains of neck pain with pain and paresthesia radiating to one upper extremity, often accompanied with muscle weakness. There are 3 main causes which produce this type of clinical picture – soft disc protrusion, hard bony constrictions or soft tissue disorder. All these causes can produce the same type of nerve root related symptoms, therefore it can sometimes be difficult to make diagnosis. Usually MRI or CT is necessary to make the diagnosis.

The bachelor thesis is divided into two parts – general and specific. In the general part the theoretical knowledge of cervicobrachial syndrome is described. It is divided into different sections discussing anatomy, kinesiology and biomechanics of the cervical spine with continuous description of the cervicobrachial syndrome form point of view of characterization, clinical picture, current therapeutic approaches, prognosis and epidemiology. The general part is meant as a brief overview of the cervical spine and the diagnosis.

The specific part is considered to be the most important. In this part the examination and therapy progress of a patient with the given diagnosis is discussed. A full examination and therapy implementation is performed using the knowledge obtained during the whole study in cooperation with advisor and supervisor. It includes conclusions of both initial and final examinations, description of executed therapy and evaluation of the effect of the therapy, the degree of success is highlighted.

In addition to general and specific part, this thesis includes list of used literature, figures, tables, explanations of abbreviations and application to ethics board review. All this can be found in the back of the thesis.

2 General Part

2.1 Anatomy and Kinesiology of the Cervical Spine

2.1.1 Anatomy

The vertebral column forms the basic structure of the trunk. It consists of 33-34 vertbrae and intervertbral discs. (1) The vertebral column is part of the axial organ together with the head, thoracic cage and pelvis, which helps the body keep the erect and upright position.

Cervical vertebrae

The seven cervical vertebrae are characterized by their small size and by the presence of foramen in each transverse process. (2) Of the seven cervical vertebrae, three can be readily distinguished:

Atlas (C1)

The major distinguishing feature of atlas is that it lacks a vertebral body, this is due to the fact that the body of atlas fuses into the body of axis during the development to become the dens (odontoid process).

Axis (C2)

The axis differs from the other vertebraes because of the odontoid process (dens) which rises perpendicularly from the upper surface of the body. The head rotates via atlas upon the dens.

Vertebrae prominens (C7)

The most distinctive characteristic of this vertebra is the existence of a long and prominent spinous process. In some subjects, the seventh cervical vertebra is associated with an abnormal pair of ribs, known as cervical ribs. These ribs are usually small, but may occasionally compress blood vessels (such as the subclavian artery) or nerves in the brachial plexus.

(1)

Types of vertebral joints

The two major types of joints between vertebrae are:

- Symphyses between vertebral bodies (Intervertebral discs)
- Synovial joints between articular processes (Zygapophyseal joints/Facet joints)

(2)

Intervertebral discs

The symphysis between adjacent vertebral bodies is formed by a layer of hyaline cartilage on each vertebral body and an intervertebral disc, which lies between the layers. The intervertebral disc consists of an outer annulus fibrosus, which surrounds a central nucleus pulposus. (2)

Facet joints

A facet joint is the articulation between the superior articular process of the vertebrae below with the inferior articular process. (3)

Uncovertebral joints

The lateral margins of upper surfaces of typical cervical vertebrae are elevated into crests or lips termed uncinate processes. These may articulate with the body of the vertebrae above to form small "uncovertebral" synovial joints. (2)

Ligaments of the spine

Joints between vertebrae are reinforced and supported by numerous ligaments, which pass between vertebral bodies and interconnect components of the vertebral arches. The ligaments of the cervical spine are devided into two groups:

Upper cervical spine

- Atlanto-occipital ligaments (anterior and posterior atlanto-occipital membranes and atlanto-occipital capsular ligaments)
- Atlanto-axial ligaments
- Atlano-axial capsular ligaments

- Axial-occipital ligaments (tectorial membrane, alar ligaments and apical odontoid ligaments)
- Nuchal ligament

Lower and middle cervical spine

- Longitudinal ligaments (anterior and posterior)
- Accessory ligaments (ligament flava, interspinous ligaments and the nuchal ligament)
- Capsular ligaments

(2)

Nervous supply to the cervical spine

There are eight cervical nerves:

- C1 to C7 emerge from the vertebral canal above their respective vertebrae
- C8 emerges between vertebrae C7 and Th1 (2)

Cervical Plexus

The anterior rami of cervical nerves C1 to C4 form the cervical plexus. The cervical plexus forms the substance of the muscles making up the floor of the posterior triangle within the prevertebral layer of cervical fascia, it consists of muscular (deep) branches and cutaneous (superficial) branches. (2)

Brachial Plexus

The brachial plexus are formed by the anterior rami of cervical nerves C5 to C8 and thoracic nerve Th1. The contributions of each of these nerves, which lie between the anterior and middle scalene muscles, are the roots of the brachial plexus. As roots emerge from between these muscles, they form the next component of the brachial plexus, the trunks:

Upper trunk: Anterior rami of C5-C6

Middle trunk: Anterior ramus of C7

Lower trunk: Anterior ramus of C8 and Th1 (2)

2.1.2 Kinesiology

The cervical spine can be divided into two sections – upper and lower cervical spine.

Upper part

The upper cervical spine includes anatomically and functionally the atlas and axis. This spinal section connects the heavy head to the slim first cervical vertebrae through the atlanto-occipital joint. Deep sub-occipital muscles (4 on each side) are accessible for palpation and are important from the diagnostic and therapeutic point of view:

- M. Rectus Capitis posterior minor
- M. Rectus Capitis posterior major
- M. Obliquus Capitis superior
- M. Obliquus Capitis inferior

All the deep sub-occipital muscles initiate the movement in this region and keep the midline and upright position of the head. Their activity is integrated and they work in simultaneous interplay. The orthogonal directions of movement in this region are flexion, extension, lateral flexion and a minimal degree of rotation of the head against atlas. The movements of flexion, extension and lateral flexion are called anterior, posterior or lateral nods. But normal movements does not only run in described orthogonal directions, but also very often in different diagonal directions as requested through the actual situation in space. Most frequent is the horizontal movement (azimuthal movement) which used to follow as a moving object in the visual filed. This movement begins by eye movements and continues with movement of the head with subsequent movement of the neck, and continues in the trunk and ends in the rotation of the whole body. Eyes pull the spinal muscles and the whole body is following the direction of the look. The turning of the head is realized by the activity of short and long muscles together on both sides synchronically. In the table below it is shown which muscles are active during turning the head to the right side (4):

On the same side	**On the opposite side**
M. Rectus Capitis posterior major dx.	M. Obliquus Capitis superior sin.
M. Obliquus Capitis inferior dx.	M. Semispinalis Capitis sin.
M. Splenius Capitis dx.	M. Trapezius sin.
M. Longissimus Capitis dx	M. Sternocleidomastoid sin.

Table 1 Muscles active during rotation of the head to the right side

Lower part

The lower cervical spine reaches anatomically from C3 until C7, but functionally it continues until 4th thoracic vertebrae. The lower cervical spine is in close relation to the upper extremity. Nerves innervating the muscles of the upper extremity exit the intervertebral foramina and form the cervical plexus, which passes through a strait in the fissura scalenorum between scalene muscles (anterior and medial). This strait is often the cause of cervicobrachial symptoms like cervicobrachial syndrome and thoracic outlet syndrome. The cervical segments C5-C6 are usually affected. To prevent this stressing of the lower cervical spine it is necessary to transfer part of the extension from cervical spine to the upper thoracic spine. This can be achieved by pressing the mandible toward the neck during the extension, this shift partially the load from the lower cervical spine to the upper thoracic spine. This action helps reduce faults in the lower cervical spine and prevents formation of deformities in this region.

Muscles of the lower part:

The muscular activity and the range of movement in the lower cervical spine depend on the position of the body. In the upright position acts the neck muscles as postural muscles and restrict the range of turning the head. In the horizontal position (supine lying) postural activity is diminished and the range of movement increases.

Muscles of the lower cervical spine (paravertebrals) are divided into three groups – ventral, dorsal and lateral, while each group consisting of three layers (4):

	Deep Layer	**Middle Layer**	**Superficial layer**
Ventral group	M. Longus Capitis M. Longus Colli	M. Suprahyoid M. Infrahyoid	Platysma
Dorsal group	Interspinal muscles Intertransversal muscles Multifidi muscles	M. Splenius Capitis M. Semispinalis Capitis M. Longissimus Capitis M. Levator Scapulae	M. Trapezius M. Sternocleidomastoid
Lateral group	M. Scalenus anterior M. Scalenus medius M. Scalenus posteior		

Table 2 Muscles of the lower cervical spine

2.2 Biomechanics of the Cervical Spine

The design of the cervical spine uniquely contributes to the structure of the human body and profoundly enhances its function. (5) All movements of the cervical spine are relatively free because of the saddle-like joints. It is most flexible in flexion and rotation. The main movements occur most freely in the upper cervical segments and are progressively restricted downward. (6)

Loads on the cervical spine

Forces acting on the spine include body weight, tension in the spinal ligaments, tension in the surrounding muscles, intraabdominal pressure and any applied external loads. When the body is in upright position, the major form of loading on the cervical spine is axial. Axial loading refers to the force directed through the top of the head and through the spine. During erect standing, the total body center of gravity is anterior to the spinal column, placing the spine under a constant forward bending. (7)

Loads during movements

Upper cervical spine (C0-C2)

The atlantooccipital joint is designed for a limited range of flexion-extension nodding movement. Translatory movements are slight and the most action is a rolling movement. Range of lateral flexion in this segment is 7° and this bending is accompanied with rotational torsion below C2. Rotation in this movement segment is considered to be 0°. The atlantoaxial segment is thus more movable. 50 % of total neck rotation occurs between C1 and C2 before any rotation is noted from C2 to C7 or in the atlantooccipital joint. After approximately 30 % of atlas rotation on the dens the body of axis begins to rotate, followed by rotation in the remaining cervical segments. If a complete fixation occurs between C1 and C2, the lower cervical segments tend to become hypermobile in compensation. As for flexion, extension and lateral flexion in this segment, movement is considered small. (6)

Lower cervical spine (C2-Th1)

All cervical vertebrae from C2 to C7 partake in flexion, extension, lateral flexion and extension, but some segments are more active in certain movements than others. Between C3 and C7 flexion and extension occur as mild gliding translation of the upper

on the lower facets, accompanied by appropriate disc distortion. The segment with greatest movement of flexion is C4-C5 segment, which explains the high incidence of arthritis at the midcervical area. Rotation below the axis is biggest near C5-C6 segment, slightly less above and considerably less below. Lateral flexion is greatest in the C2-C5 segments and decreases caudally. Total ROM in individual segments of the cervical spine is shown in table below (6):

Motion segment	**Movement**	**Degrees**
Atlantooccipital	Flexion	10°
	Extension	15°
	Lateral flexion	7°
	Rotation	3°
Atlantoaxial	Flexion	11°
	Extension	1°
	Lateral flexion	2°
	Rotation	45°
C2-C3	Flexion/extension	8°
	Lateral flexion	10°
	Rotation	9°
C3-C4	Flexion/extension	13°
	Lateral flexion	10°
	Rotation	12°
C4-C5	Flexion/extension	19°
	Lateral flexion	10°
	Rotation	12°
C5-C6	Flexion/extension	17°
	Lateral flexion	8°
	Rotation	14°
C6-C7	Flexion/extension	16°
	Lateral flexion	7°
	Rotation	10°
C7-Th1	Flexion/extension	9°
	Lateral flexion	4°
	Rotation	8°

Table 3 ROM in individual segments of the cervical spine

Cervical lordosis

The normal curve of cervical lordosis is important under the physiological axial load-bearing conditions because it accepts and distributes force to vital load-sharing structures such as the facets. The alignment of the articulating surfaces of the facet joints approximates a coronal plane orientation and thus, as the neck is extended, the facets participate in load bearing. The cervical lordosis is also a biomechanically superior alignment for the cervical musculature and supporting structures. (8) The force of gravity on the cervical lordosis normally falls anterior to the support of the posterior cervical musculature. When the lordosis flattens, a large workload is placed on the musculature of the neck to maintain biomechanical integrity. The cervical lordosis flattens in the non-weight-bearing supine position. Likewise, they adapt comparatively fast to changes involving the direction of force. Different loading is present when the cervical spine is in hypo- or hyperlordosis. During hypolordosis, more weight is placed on vertebral bodies and discs, while in hyperlordosis most weight is borne by the facets. Numerous studies have discussed what the normal cervical curve should be, and most seem to be in agreement that the cervical lordosis extends down to Th2, with C5 being the stress point. (6)

2.3 Disease

2.3.1 Characterization

Sucher B.M. explains that Cervicobrachial syndrome is a nonspecific term describing a combination of pain, numbness, weakness and swelling in the area of neck and shoulder. The word "syndrome" refers to a collection of symptoms which is commonly seen together, but there is no known explanation. The term "cervicobrachial syndrome" should therefore refer to a collection of neck and arm symptoms for which there is unknown cause. (9)

Cervicobrachial syndrome can be caused by either soft disc protrusion or hard bony constrictions (osteophytes) at the uncinate process. These two different mechanisms produce distinct syndromes that differ in their manifestations and clinical pictures. Their common feature is dermatomal brachialgia. (10) Differences can be seen in the table below:

	Disc protrusion (soft compressive lesion)	**Uncovertebral osteophytes (hard compressive lesion)**
Age	30-45	50-65
Onset	Sudden	Gradual
Leading symptom	Abnormal posture of neck	Brachialgia
Radiological findings	Loss of cervical lordosis due to muscle spasm	Uncovertebral osteophytes
Course	Acute	Chronic
Response to conservative treatment	Good	Poor

Table 4 Distinguishing clinical features of soft and hard cervical nerve root compression (10)

A third cause of cervicobrachial symtoms can be soft tissue disorder, commonly known as pseudoradiculopathy. (11)

2.3.2 Clinical Picture

The clinical symptoms can appear sudden or gradually and are governed by a dermatome-related brachialgia that is position dependent. The afferent fibers in the spinal nerve have to first be converted to nociceptors. (12)

In the clinical picture of cervicobrachial syndrome there can be found various clinical states or combination of states according the severity of the cause:

Radiculopathy

Cervical radiculopathy is characterized by signs and symptoms related to cervical nerve root dysfunction. The patient usually presents with neck pain that radiates into the arm. It can be associated with loss of motor function, sensory loss or reflex changes in the nerve root distribution. The most common causes of cervical radiculopathy are cervical disc herniation (most commonly posterolateral) and spondylosis (osteophytic spurs) causing nerve root compression.

Clinical symptoms according affected nerve root

The most monoradicular cervicobrachial syndromes involve the intervertebral disc C5-C6, affecting nerve root C6 (C6 syndrome). This followed by intervertebral disc spaces C6-C7 and C7-Th1 with the associated C7 and C8 syndromes. Nerve root irritation syndromes of C3 (C2/3 disc) and C4 (C3/4 disc) are very rare.

C5 Syndrome

This syndrome is relatively rare (4,1 % of all syndromes), it generally does not have any characteristic symptoms. There is no pain or sensory disturbances of the hand. The pain is largely limited to the shoulder region. The C5 syndrome can easily be confused with the humeroscapular periarthropaty. (10)

C6 Syndrome

Biggest number (36,1 %) of monoradicular cervicobrachial syndromes is due to lesions of the C5/6 segment. The C6 dermatome extends down the radial side of the arm as far as tip of the thumb. Part of the index finger may be included as well. In some cases the biceps tendon reflex is weakened. (10)

C7 Syndrome

This syndrome is the second most common type, accounting for 34, 6 % of cervicobrachial syndromes. Pain radiates from the common dorsolateral pain field of the shoulder and forearm down to the extensor surface of the forarm and proceeds to second, third and (partially) fourth finger. Pain and paresthesia are felt at the volar side of these fingers. The C7 myotome consist of triceps brachii , pronator teres, abductor pollicis brevis, opponens pollicis and flexor pollicis brevis. Weakness of active elbow

extension is common in addition with weak or absent triceps tendon reflex. Athrophy of the thenar muscles may appear. (10)

C8 Syndrome

This syndrome accounts for 25, 2 % of cervicobrachial syndromes. Pain and paresthesia are felt in fourth and fifth fingers. There may be weakness of finger flexors, interossei muscles and hypothenar muscles. (10)

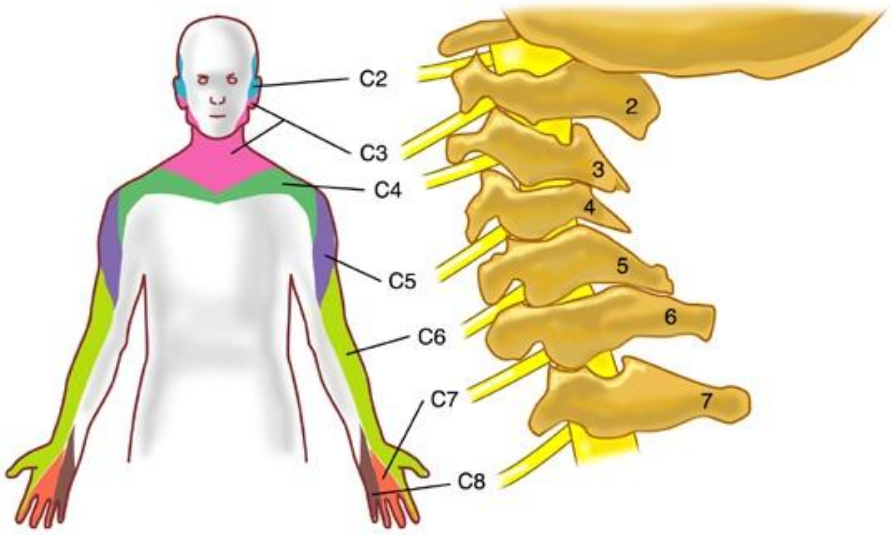

Figure 1 Paresthesia according to spinal segment

C7 is the most commonly affected nerve root, followed by C6, C8 and C5 in descending order of incidence. Radiculopathies of C2 to C4 are thought to be uncommon and clinically difficult to distinguish from other sources of pain. The exact pathogenesis of radicular pain is unclear, but it is thought that inflammation in addition to compression is necessary for the pain to develop. (13)

Pseudoradiculopathy

Upper extremity musculoskeletal disorders and radiculopathy may present with similar pain-referral patterns, this is known as pseudoradiculopathy. Shoulder, elbow, wrist, hand and myofascial pain syndromes can all contribute these pain-referral patterns. Tear and tendonitis of rotator cuff, impingement syndrome and subacromial bursitis may lead to weakness and pain pattern similar to lesions of C5 and C6 nerve roots because they innervate the rotator cuff muscles. Lateral epicondylitis may produce similar symptoms

as C6/C7 lesion, this is because extensor muscles are innervated by these nerve roots. Pain pattern in relation to C8 radiculopathy may be caused by medial epicondylitis as it involves the flexor and pronator muscles which are innervated by C8 nerve root. Myofascial pain syndromes can also contribute to pseudoradiculopathy in the sense of active trigger point activity. These syndromes present with pain in a referred pain pattern that is specific for the muscle in which the trigger point is located. Each muscle has its own specific pain-referral pattern and many of them may be similar to dermatomal patterns of cervical nerve roots. (11) These syndromes are illustrated in the 2 figures below:

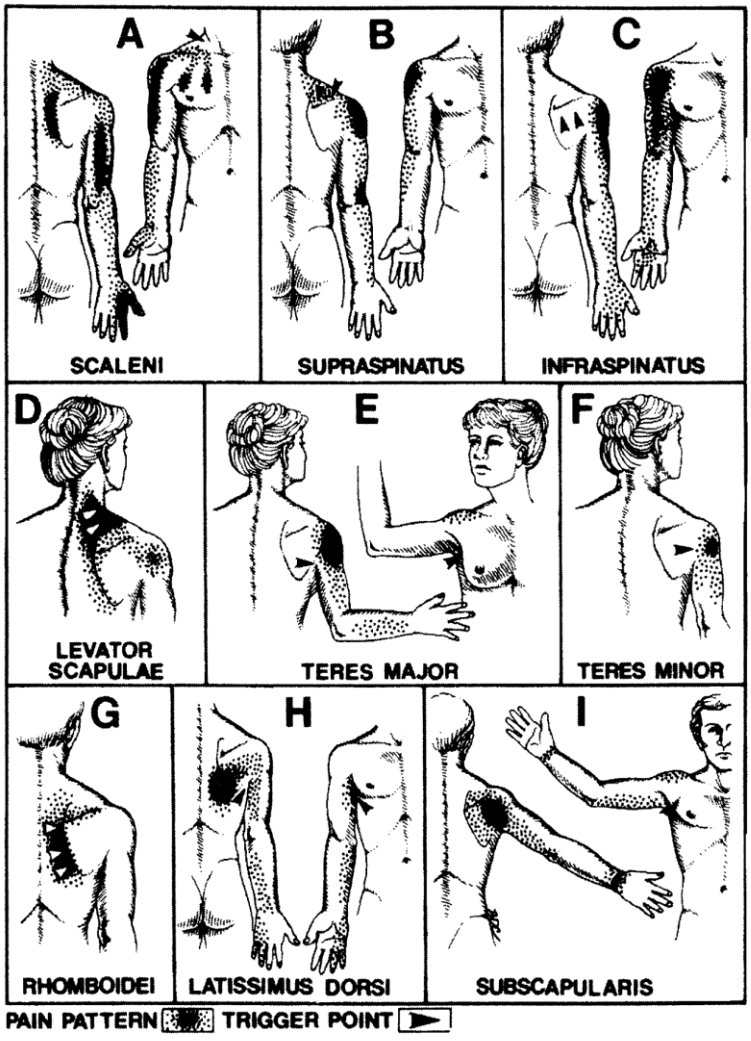

Figure 2 Referred pain patterns and location of trigger points for neck and arm muscles that refer pain to upper extremity

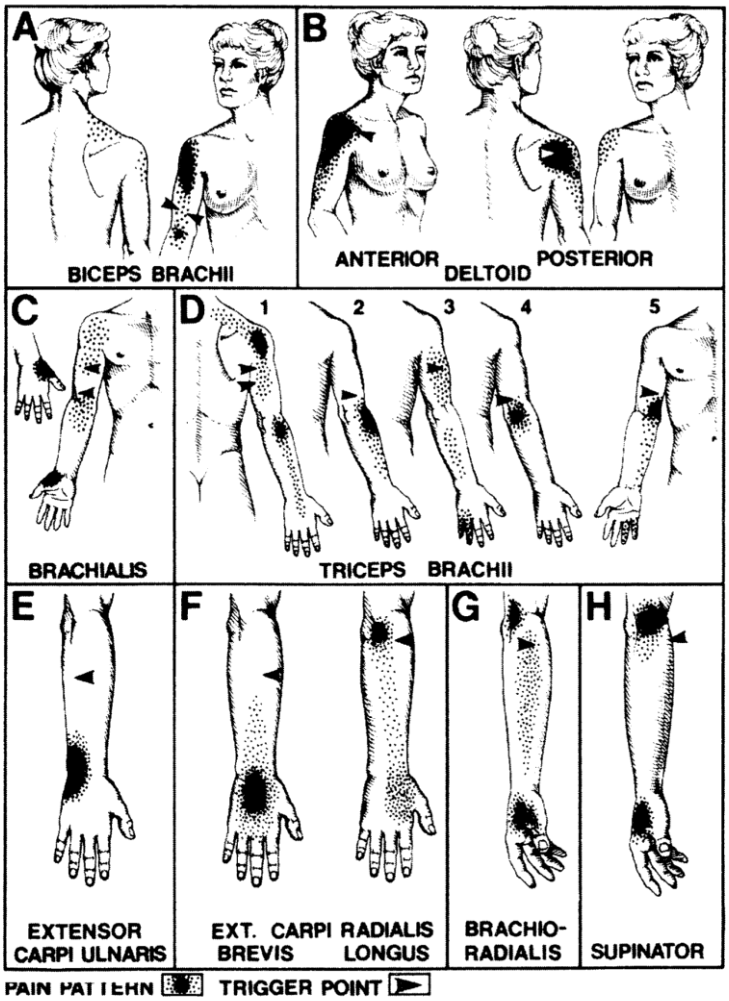

Figure 3 Referred pain patterns and location of trigger points for the arm and a number of forearm muscles

Cervical Myelopathy

Cervical myelopathy refers to a complex of symptoms caused by compression of the cervical spinal cord. The most common cause is cervical spondylosis which leads to stenosis and spinal cord compression. (14) Myelopathy due to spondylosis has no single pathognomonic sign or symptom, but the most common combination of symptoms in patients with this condition are weakness and clumsiness of the hands, paresthesias in the hand, and gait disturbances. (15)

Even though all these clinical states can be related to cervicobrachial syndrome, osteophytic reactions on the uncinate processes which lead to brachialgia are much more common than disc protrusions or prolapse. (10)

2.3.3 Epidemiology

Neck pain is a common problem in the general population. It occurs at some time in one-third or more of the population. (16) Cervicobrachial pain syndrome is a very common condition in the general population. The precise incidence of cervicobrachial syndrome is not known because of the lack of precision in the definition of the diagnosis and the differences in the way in which population-based studies have been conducted. (17)

2.4 Etiopathogenesis

2.4.1 Cervical Osteophytes

Osteophytes are better known as bone spurs. (18) They are protrusions of the superior or inferior aspects of the vertebral bodies that are composed of compact bone and extend toward the adjacent intervertebral disc and vertebral body. (19) They commonly occur in elderly people or patients with degenerative conditions of the spine. Vertebral osteophytes are formed as a secondary reactive process to primary degenerative changes of spinal motion segments. They develop in places where there is high compression load and the original tissue fails to keep the normal formation, e.g. intervertebral discs. (18) One important function of healthy, well-hydrated intervertebral disc is to unload the uncovertebral joints. The effect can be reduced in the case of a degenerated or dehydrated disc. Over time increased compression force on the uncovertebral joint may stimulate the formation of an osteophyte. Osteophytes develop in accordance with the century old *Wollf's Law* that states "Bone is laid down in areas of high stress and reabsorbed in the areas of low stress". A large osteophyte may compress on a descending spinal nerve root and produce pinched nerve syndrome with pain and weakness of the affected nerve root. (20)

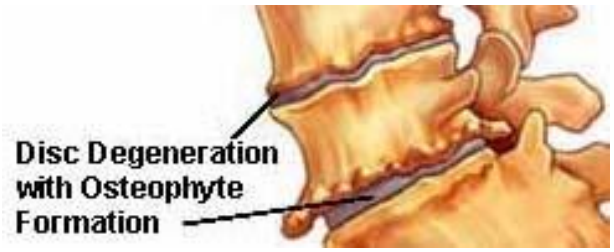

Figure 4 Cervical osteophyte formation

2.4.2 Osteoarthritis

Cervical osteoarthritis is the most common cause of neck pain in individuals over the age of 40. Radiographic evidence of cervical osteoarthritis is present in over 70% of the elderly population. (21) Osteoarthritis in the cervical spine is in the effect the later stage of spondylosis, marked by progressive degeneration of the intervertebral discs and especially the intervertebral joints (trijoint complex). Osteoarthrotic changes can include osteophyte formation, hypertrophy of the synovial membrane and chronic inflammatory response. Osteoarthritis includes the

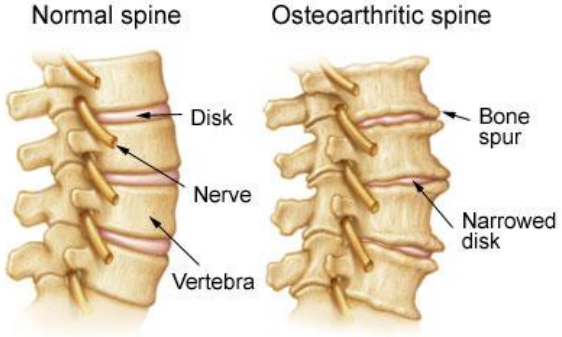

Figure 5 Cervical Osteoarthritis

zygapophyseal joints, which show degeneration of the articular surfaces and increased stiffness of the subchondral bone. These changes lead to a decrease in the intervertebral disc space, osteophyte encroachment into the intervertebral foramen, hypertrophy of the soft tissue (especially ligament flava) and encroachment on the spinal cord or vertebral artery. (22)

2.4.3 Osteochondrosis

Osteochondrosis involves degeneration of the disc and the cartilaginous base and end plates of the vertebral bodies. This results in sclerosis of the cartilaginous tissue and in deformation of the vertebral bodies. The intervertebral disks lose height, and the vertebral bodies on either side are brought closer together. There is also bony over-growth of the facet joints (spondyloarthrosis) and of the vertebral bodies themselves, in the cervical region this is called cervical arthrosis. These processes cause stenosis of the intervertebral foramina, with compression of the tissues within them, including the nerve roots. (23) Osteochondrosis usually causes hypomobility of C5-C7, frequently with hypermobility of the higher cervical segments. (24)

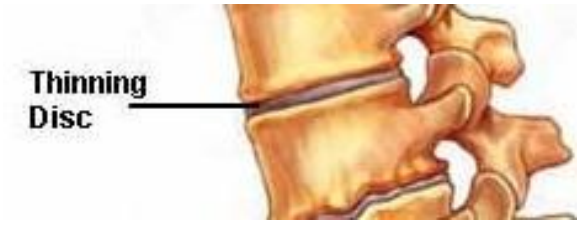

Figure 6 Cervical Osteochondrosis

2.4.4 Cervical disc herniation

Disc herniation is typically preceded by degenerative changes in the mucopolysaccharides of the nucleus pulposus, which produce fibrillation of the collagen. This eventually causes dehydration and loss of disc volume. As a result, the nucleus pulposus no longer serves as a normal load-dispersing mechanism, and excessive stress is borne by the annulus fibrosus. This produces annulus fissuring and tears that can culminate in herniation of the nucleus pulposus. (25) Patients typically complain about frequent headaches, with pain that originates around the paraspinal muscles and radiates down one of the upper extremities. Symptoms of finger numbness and tingling typically occur in conjunction with neck and arm pain. In some

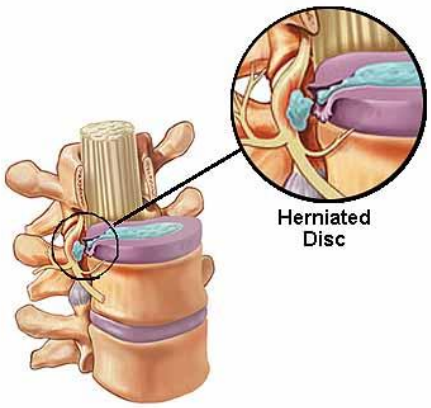

Figure 7 Cervical disc herniation

patients, a herniation can cause a spinal cord compression where the disc material pushes directly on the spinal cord. (26)

2.5 Current Therapeutic Approaches

Treatment of cervicobrachial syndrome should be conservative and symptomatic. (9) In the cases were conservative treatment did not have any significant effect, surgery is indicated. All cervical disc syndromes are treated with the same set of therapeutic techniques despite their varying pathogenesis and manifestations. It depends on acute or chronic phase in which sequence the techniques are applied. It is often useful to apply multiple treatment strategies simultaneously. The aim of treatment is to take care for the motor components of the condition, and also its secondary manifestations. Heat, electrotherapy, massage and analgesics are intended to alleviate the secondary manifestations, and relieve pain, muscle tension and abnormal posture. Etiological (cause-directed) and symptomatic treatments should be given parallel. Example of etiological causes is structural deformation, short-term postural changes and hypermobility. The purpose of the etiological treatment is to eliminate one or more of these disease-producing mechanisms. (10)

There are two main goals of treatment:

1. Decrease pain
2. Increase function

(9)

2.5.1 Physiotherapy

Physiotherapy treatment of cervicobrachial syndrome may consist of deep heat, ultrasound, electric stimulation, postural correction, strength and endurance exercises. Stretching exercises for the neck and shoulder in addition with spinal manipulation and mobilization may improve the function. (9) In the cases where there are weakened muscles they have to be strengthened.

Physical therapy

Heat

The application of heat is an important component of treatment in cervicobrachial syndrome. It is indicated in the first onset of symptoms. Heat gives its beneficial effect through hyperaemia and release of tension in the shoulder and neck muscles. This is followed by a reflex effect in the corresponding motion segments. Deep heat decrease

local irritation of the ligaments and periosteum. It also influences the speed of conduction of the motor nerves and the activity of spinal α- and γ-motor neurons, to relax painful and tense muscle zones. The application of heat can either be directly by the contact of a warm object or indirectly by radiant heat. (10)

Electrotherapy is indicated for chronically recurrent symptoms. (10)

Soft Cervical Collar

A soft cervical collar is a therapeutic device which is both simple and inexpensive. It provides support and partial immobilization of the cervical spine. It should be used during the acute phase of the disease. The collar should be of the same height all around. A properly fitted collar has three beneficial effects:

- Immobilization
- Warmth
- Release of stress

Pain can often occur by movements of the head that the patient makes unthinkingly while a wake or during sleep, so the collar should also be used during the night. The collar reduces mechanical stress and decrease the pain. It can also provide a mild degree of cervical traction. (10)

Massage therapy

Massage therapy is indicated in the chronic phase of the cervicobrachial syndrome. In the acute phase massage can worsen the pain by manipulation of the neck which leads to irritation in the nerve root of the affected segment. Massage is intended to reduce tension in the shoulder and neck muscles. The benefits of massage are its direct mechanical effect and reflex effect of the motion segment. Adhesions between muscles are separated and the flow of blood and lymph in the area is promoted. Muscles tension is relieved and also the intradiscal pressure. The patient must be in proper position before applying the massage. Recommended positions are sitting or lying with the cervical spine in a mildly flexed position. (10)

Manual therapy

Manual treatment of cervicobrachial syndrome is indicated for acute, painful (not severe pain) restriction of movement in the cervical spine. The goal of manual therapy of the cervical spine is to return disturbed motion segments to their neutral position. This generally involves pulling in the axial direction (traction). Brief powerful pulling lowers the intradiscal pressure with a suction-like effect. Manual therapy with traction relieves mechanical stress on the motion segments and brings them back to neutral position. (10) McKenzie method is considered as a effective manual therapy for cervicobrachial syndrome.

McKenzie Method

McKenzie is a spinal rehabilitation method founded by Robin McKenzie. The goal of the rehanilitation is independence in self-care. To serve that purpose, spinal rehabilitation promotes self-efficacy. McKenzie method is especially effective in rehabilitation of common lower cervical and lower lumbar syndromes. Method uses patient-generated movement for acute and chronic symptoms. Whether acute or chronic, this concept and skills promote independence in self-care from day one, without passive therapy detours on the rehabilitation on the road to recovery. The McKenzie method educates patients regarding movement and positioning strategies that have potential to rapidly improve complaints. The three syndrome patterns of mechanical and symptomatic responses to loading for which therapeutic movement and positioning strategies may be helpful is:

1. The Postural Syndrome
2. The Dysfunction Syndrome
3. The Derangement Syndrome

(27)

Strengthening exercises

Strengthening exercises for cervical spine – and upper extremity muscles is part of both the acute phase and the long term rehabilitation phase. After successful initial treatment it is important to stabilize the neck in order for the good result to last. The muscles can be strengthened with long-lasting results by isometric muscle-tensing exercises. They involve no movement of the head or neck. Isotonic muscle contraction is not preferred

in the rehabilitation of patients with cervicobrachial syndrome because they may lead to irritation of the spinal nerves. (10)

2.5.2 Pharmacotherapy

Pharmacotherapy

The pharmacological treatment of cervicobrachial syndrome is purely symptomatic and should be applied in parallel with physiotherapy. The treatment of acute severe pain should start with administration of a powerful analgesic. Sedatives and tranquilizers can also be given as a combination or add-on therapy. Tranquilizers lessen the mechanical irritation of the neural elements of the motion segments, decreases the pain and muscle spasms. Psychoactive medication may be indicated for a brief period since the nocturnal pain can produce physical and emotional stress. Diazepam is valuable in this context as a barbiturate-free (free of CNS-depressants) sedative psychoactive drug and muscle relaxant. It can be given as a supplement to other, parallel treatments. (10) If vascular compression is recognized, vasodilators or calcium-channel blockers may be prescribed. (9)

Local Injections in the Cervical Spine

If other conservative treatments such as rest, heat and analgesics fail to relive pain and muscle spasms it is considered to use local injections. This treatment is often provided initially, mainly in cases of acute cervicobrachialgia. The local injection of analgesics and anti-inflammatories goes straight to the source of pain. Local injections are intended to break the viscious circle of pain, muscle tension at the precise site where it arises. Examples of different injections are:

- Local muscle infiltration
- Cervical sympathetic and radicular blockade
- Cervical epidural injection
- Cervical facet infiltration

(10)

2.5.3 Surgical treatment

Surgical treatment of cervicobrachial syndrome is indicated when all conservative methods including nerve root blocks have failed to relieve the pain. (10) Surgery for degenerative diseases involves two main components: removal of cause of pain and fusing the spine to control movement. (28)

Decompression surgeries

1. Facetectomy: removal of facet joint to reduce pressure
2. Foraminotomy: making the opening of a foramen larger
3. Laminectomy : removing part of the lamina
4. Laminotomy: making a larger opening between spinal canal and spinal cord
5. Discectomy: remove whole or part of a disc
6. Vertebrectomy: removal of vertebral body

(28)

2.6 Prognosis

Recovery from cervicobrachial syndrome may be complete, partial or very limited. If the cause of the syndrome is nonspecific the treatment will be less focused and the outcome will be uncertain. (9)

In case when the syndrome is caused by soft disc protrusions the prognosis is significally better than those who suffer from ostephyte formation at the uncinate process. This is due to the fact that the onset of soft disc protrusions are sudden, the average age of onset is lower and result of conservative treatment is better. (10)

Cervicobrachial syndrome due to uncovertebral osteophytes has a gradual onset, higher average age of onset and tends to recur chronically. Repeated attacks can be caused by external forces (acceleration-deceleration injury) or have prolonged maintenance by unfavorable posture. The symptoms diminish in intensity in old age when the motion segments become increasingly immobile. (10)

Factors which influence the length of disability include severity of symptoms, patient's job requirements, underlying psychosocial problems or sleep disturbances associated with the disability, and the lack of adequate coping skills. Inadequate response to treatment of chronic pain in combination with psychological issues or sleep disturbance may influence the duration. (9)

3. Special Part

3.1 Methodology

My bachelor practice took place at Ústřední Vojenská Nemocnice, Prague, from 14.01.13 until 25.01.13. UVN is the Military University Hospital in Prague. The hospital is a training, educational and professional medical facility of the army of the Czech Republic, which provides comprehensive health care at the level of teaching hospitals. (29)

My case study was underdone at the neurological department in the hospital. The department specializes in low back pain, neck pain, vertigo, post neurosurgery patients, stroke and many other neurological diseases. The department has an exercise room with benches, fitness balls, redcord and ergometer cycle. The department also offers electrotherapy and solux.

My study was supervised by Mgr. Markéta Ptáčková, her specialized field is the McKenzie method. All examinations and therapeutical approaches were done in cooperation with her.

My patient was informed from the beginning, and my work has been approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University in Prague with the approval number 047/2013.

3.2 Anamnesis

Performed 17.01

Name: M.B, Male

Year of birth: 1945

Status praesens

Height: 186 cm

Weight: 89 kg

BMI: 25,7

BP: 127/79

HR: 72/min

BF: 14/min

2nd day of hospitalization

Diagnosis

M509 Disease of the cervical intervertebral disc.

Summary of diagnosis

Cervicobrachial syndrome with irritative symptomatology C7 on left side without sensomotoric deficit.

Chief Complaint

Pain in the cervical spine with projection of pain to the left upper arm, area of axilla, between scapulas and forearm with intermittent radiation to the 2nd to 4th finger. Pain is described as burning pain and on a pain scale from 1 to 10 it is considered 10. The pain is mostly present at night, and when he is lying down. He cannot lie on his left side. As a pain relief he is standing up and walking during the night, sometimes for several hours.

History of present problem

The pain in the cervical spine started 5 weeks ago from unknown cause, but worsened when he flexed his head. The pain propagated to the left trapezius and shoulder, and sometimes it got worse and projected into the back side of left upper arm across the elbow all the way to 2nd to 4th finger of the same arm. It worsened during standing still doing nothing and during movements like extension and lateral flexion and rotation to the left side.

Medical history

Diseases

Paroxsysmal Atrial Fibrillation – treated with medication for 2 years

Injuries

1993: Rupture of Achilles tendon in a skiing accident

Past surgeries

1960: Appendectomy

1993: reconstruction of Achilles tendon

1998: Cholesystectomy

2003: Cataract of both eyes

2005: Arthroscopy of right knee - Menisectomy

Pharmacotherapy

Warfarin – Anticoagulant

Rytmonorm – for Paroxsysmal Atrial Fibrillation

Cardilan – Support of heart function

Dihydrocodeine Continus – Opioid painkiller

Infusion therapy from 17.01.13:

- Sodium Chloride
- Guajacuran (relieve tension in nuchal muscles)
- Natrium Salicylium Biotika

Infusion therapy from 20.01.13

- Sodium Chloride
- Guajacuran
- Dexamed (Anti-inflammatory steroid)
- Mesocain

Allergies None

Family history

2 brothers with cancer – stomach and lungs

Psychosocial history

Occupation

Pensioner for 3 years, before that he was a driver for 45 years

Hobbies

Walking, mountain hiking, working at his cottage, garden work, cycling

Living condition

He lives on 7th floor in a flat with elevator

Married: Yes

Children: 2

ADL: He manages all ADL fine

Smoking: No

Alcohol: In social occasions

Sport anamnesis

He has been doing 10-15 push-ups every day for the last 15 years. In his younger days he was playing football and volleyball for fun, and was working out at the gym by weight lifting.

Previous rehabilitation

The doctor prescribed 6 sessions of ultrasound therapy for upper trapezius, but he was stopping after the 4th session because it made the pain worse.

Excerpt from patient's health documentation file

CT of cervical spine performed 15.01.13:

Flat lordosis, osteochondrosis of C5/C6 with dorsal osteophytes on the right side which markedly narrows the right side of the foramen. The other foramens are without any significant narrowing. Advanced arthrotic changes in C1/C2. The spinal canal is otherwise free.

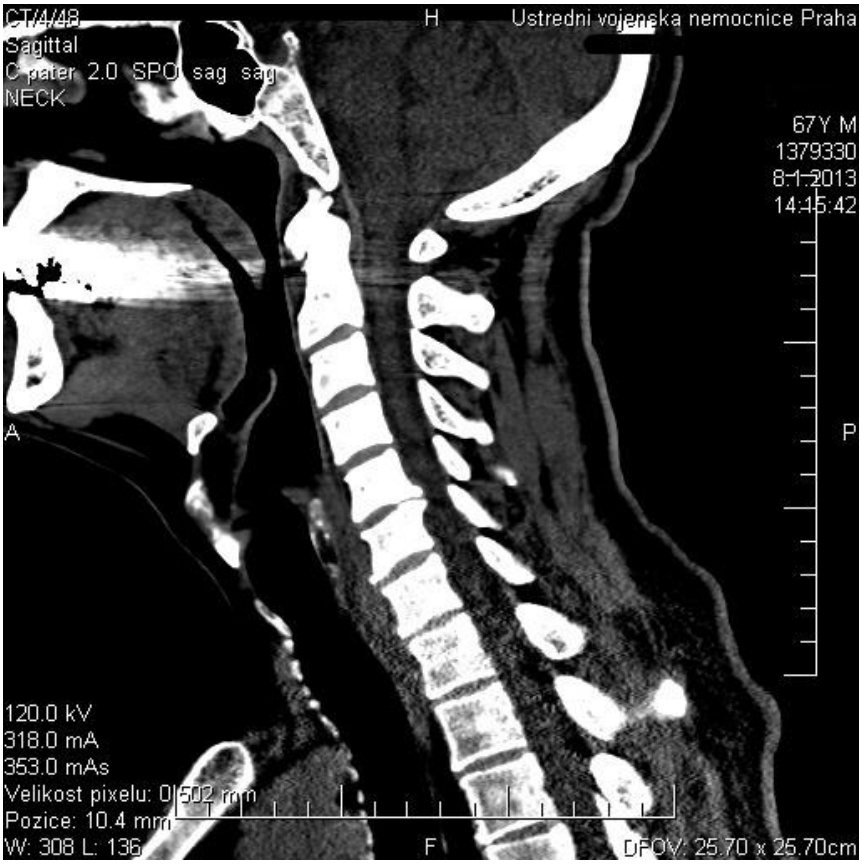

Figure 8 CT of Cervical Spine

Indication of rehabilitation

Patient is indicated for infusion therapy and rehabilitation

Differential consideration

- Degenerative changes of the cervical spine
- Mechanical problems – loading of the cervical spine
- Changes of posture that lead to problems
- Hypertone of muscles
- Blockage of joints in the cervical spine
- Flat lordosis of cervical spine with decreased ROM

3.3 Initital Kinesiologic Examination

Examinations were performed 17.01

3.3.1 Posture examination

Posterior view

- Narrow stance
- ER of legs – more on the right side
- Popliteal line is higher on right side
- Atrophy of gluteals
- Thoracobrachial angle is bigger on left side
- Left scapula is more prominent (dorsal winging)
- The shoulders are broader than the hip
- Elbows are flexed

Lateral view – right

- Frontal loading of lower extremity
- Normal extension of knees
- Slight hyperlordosis of lumbar spine
- Big kyphosis of thoracic spine – extends all the way to C/Th-crossing
- Sligth lordosis of cervical spine
- Protraction of shoulders
- Forward head position
- Slight flexion of head

Lateral view – left

- Confirmation of the right side

Anterior view

- Physiologic arches – longitudinal and transversal
- Hallux valgus on both feet, bigger on left
- More loading on left foot
- Body shifted to the left side
- Left shoulder is higher
- Head rotated to the left side

3.3.2 Gait examination

- Clasps feet – no physiological unroll
- Short stance
- No extension of legs
- ER of feet
- Left arm swings more
- Right arm is close to the body
- Stiff trunk
- Frontal position of both upper extremities

3.3.3 Pelvis examination

Crista: Higher on right side

PSIS: Higher on right side

ASIS: Higher on right side

Result: Lateral pelvic tilt to the left side

3.3.4 Spine distances

Flesch de Forestier: 9,5 cm

Cepoj's distance: 3cm – physiological

3.3.5 Range of motion – active motion for orientation

Cervical spine

Motion	**Result**
Flexion	Chin on breast, no pain
Extension	Painfull, stops at 20°
Lateral flexion - left	No pain, 35°
Lateral flexion - right	No pain, 30°
Rotation left	Feels tension around the whole neck, 25°
Rotation right	Feels tension around whole neck, 25°

Table 5

All movements were tested in sitting position

Shoulder joint

Motion	Result right	Result left
Abduction	170°	175° *
Adduction	0°	0°
Flexion	175°	175°
Extension	40°	40°
External rotation	35°	30°
Internal rotation	Able to do it – hand on ribs	Able to do it –hand on ribs

Table 6

All movements were performed in sitting position except extension (standing), because the patient's pain worsens in lying position.

*= Movement accompanied with pain

Elbow joint

Motion	Result right	Result left
Flexion	135°	135°
Extension	0°	0°
Supination	90°	90°
Pronation	90°	90°

Table 7

Wrist joint

Motion	Result right	Result left
Dorsiflexion	70°	70°
Palmarflexion	80°	80°
Radial duction	15°	15°
Ulnar duction	30°	30°

Table 8

Functional movement of fingers

Abduction: Able to perform

Adduction: Able to perform

Flexion: Able to perform

Extension: Able to perform

Opposition: Able to perform between thumb and all 4 fingers

Lumbricales: Able to perform

3.3.6 Muscle length test according Janda (30)

Tested muscle	Grade right	Grade left
Levator Scapulae	2	1
Sternocleidomastoid	2	2
Scalene	2	1
Cervical lateral flexion	2 (30°)	1 (35°)

Table 9

3.3.7 Examination of basic movement patterns according Janda (27)

Movement pattern	Result
Shoulder abduction	No pain. Performed motion until 90° with elbows in 90° flexion. Upper part of trapezius acts as a prime mover, especially on the left side. No lateral flexion of the trunk during movement. Symmetrical range of motion.
Neck flexion	No pain, but he felt tension in the area of axilla and scapula on the left side during movement. He is able to put the chin on his breast. He is using accessory trunk muscles to perform the flexion, his whole thorax is moving in cranial direction and his ribs are flaring outwards. He shakes his head during the motion and there is big tension (prominent tendons) of his sternocleidomastoid muscle.
Push up	No pain, but it felt tiring after 3 repetitions. He has more activity/strength of his right arm, it depresses and elevates before the left one. His left scapula is more prominent (winging)

Table 10

3.3.8 Neurologic examination

Dermatome sensation

Touched area	Result
C3 – Supraclavicular fossa	Same on both sides
C4 – Acromioclavicular joint	Same on both sides
C5 – Lateral antecubital fossa	Same on both sides
C6 – Thumb	Same on both sides
C8 – Little finger	Same on both sides
Th1 – Medial antecubital fossa	Same on both sides
Th2 – Apex of Axilla	Same on both sides
Th3 – Midclavicular line	Same on both sides
Th4 – Level of nipples	Same on both sides
Th5 – Level of xiphoid process	Same on both sides

Table 11

Test of deep tendon reflexes

Reflex	Grade right	Grade left
C5/C6 - Biceps	2	2
C7 - Triceps	2	2
C8 - Flexors	2	2

Table 12

3.3.9 Muscle strength testing according Kendall of C7 root muscles (30)

Tested muscle	Grade right	Grade left
Brachialis (with biceps)	5	5
Coracobrachialis	5	5
Serratus Anterior	5	5
Teres Major	5	5
Pectoralis Major	5	5
Pectoralis Minor	5	5
Extensor Carpi Radialis Longus	5	5
Flexor Carpi Radialis	5	5
Flexor Carpi Ulnaris	5	5
Pronator Teres	5	5

Supinator	5	5
Latissimus Dorsi	5	5
Triceps Brachii + Anconeus	5	4
Abductor Pollicis Longus	5	5
Extensor Digitorum	5	5
Extensor Digiti Minimi	5	5
Extensor Indicis	5	5
Extensor Pollicis Longus	5	5
Extensor Pollicis Brevis	5	5
Flexor Pollicis longus	5	5
Palmaris Longus	5	5
Pronator Quadratus	5	5
Extensor Carpi Radialis Longus	5	5
Extensor Carpi Radialis Brevis	5	5

Table 13

3.3.10 Examination against isometric resistance of rotator cuff according Cyriax (31)

Movement	**Result right**	**Result left**
Against ABD	No pain	No pain
Against raising of semiflexed arm	No pain	No pain
Against ER	No pain	No pain
AgainstIR	No pain	No pain

Table 14

3.3.11 Palpation

Muscles

Muscle	**Result right**	**Result left**
Upper trapezius	Normal	Hypertone*
Supraspinatus	Normal	Hypertone*
Infraspinatus	Normal	Normal
Subscapularis	Normal	Hypertone *
Paravertebral upper	Normal	Hypertone

Paravertebral middle	Normal	Normal
Paravertebral lower	Hypertone	Normal
Pectoralis major	Normal	Hypertone*
Pectoralis minor	Normal	Hypertone
Deltoid	Hypertone	Normal
Triceps	Normal	Hypotone
Biceps	Normal	Hypotone

Table 15

*= Triggerpoint

Palpation of skin and fascia

Skin-drag test:

- Tight skin in the upper part of back and neck on the left side

Kibler's fold

- Tight fascia in the whole area of upper back en neck, but worse on the left side

Palpation of fascia of the neck

- Fascia is more restricted in the left direction

3.3.12 Examination of joint play according Lewit (31)

Joint	**Result right**	**Result left**
1st rib (springing to opposite hip)	No blockage	No blockage
2nd rib (overtake phenomenon)	No blockage	No blockage
3rd rib (overtake phenomenon)	No blockage	No blockage
4th rib (overtake phenomenon)	No blockage	No blockage
5th rib (overtake phenomenon)	No blockage	No blockage
6th rib (side-bending in insp + exp)	No blockage	No blockage
7th rib (side-bending in insp + exp)	No blockage	No blockage
8th rib (side-bending in insp + exp)	No blockage	No blockage
9th rib (side-bending in insp + exp)	No blockage	No blockage
10th rib (side-bending in insp + exp)	No blockage	No blockage
11th rib (side-bending in insp + exp)	No blockage	No blockage

12th rib (side-bending in insp + exp)	No blockage	No blockage
Acromioclavicular: cranio -caudal	No blockage	No blockage
Acromioclavicular: ventro-dorsal	No blockage	No blockage
Atlantooccipital : Lateral flexion	No blockage	No blockage
Scapula – circular movement*	Movable	Movable
Scapula – ABD + elevation*	Movable	Movable
C/Th – Cross: ventro-dorsal (sitting)	No blockage	No blockage
C/Th – Cross: latero-lateral (sitting)	No blockage	No blockage
1st Thoracic (Flexion and extension)	No blockage	No blockage
2nd Thoracic (Flexion and extension)	No blockage	No blockage
3rd Thoracic (Flexion and extension)	Restricted E	Restricted E
4th Thoracic (Flexion and extension)	Restricted E	Restricted E
5th Thoracic (Flexion and extension)	Restricted E	Restricted E
6th Thoracic (Flexion and extension)	No blockage	No blockage
7th Thoracic (Flexion and extension)	No blockage	No blockage
8th Thoracic (Flexion and extension)	No blockage	No blockage
9th Thoracic (Flexion and extension)	No blockage	No blockage
10th Thoracic (Flexion and extension)	No blockage	No blockage
11th Thoracic (Flexion and extension)	No blockage	No blockage
12th Thoracic (Flexion and extension)	No blockage	No blockage

Table 16

*Testing the mobility of scapula against thorax

Further joint play examination of the cervical spine were not performed due to pain

3.3.13 Examination of breathing pattern

- Lower thoracic breathing → ribs flare out
- Small activity of the abdominals
- 14 breaths per minute

Conclusion of examination

In the posture examination I found that he has a narrow base, and that his shoulders are broader than his hips. In relation to problem area is his left shoulder higher and the left scapula is more prominent. He has a forward head position and it is rotated to the left side. He has only slight lordosis of the cervical spine, otherwise it is flat. His shoulders are protracted.

The gait examination shows that he has short stance phase with no extension of the knees and no physiological unroll. He has external rotation of his feet and frontal position of both upper extremities, it's like he is leaning forward when walking. He has a quite stiff trunk, which doesn't move.

Regarding spine distances he had physiological "Flesch de Forestier and "Cepoj's distance".

The most critical findings were ROM in his cervical spine, with extension being the worst with 20°. It was also really painful (10/10 on the pain scale). When he performed rotation he felt tension around the whole neck in both directions. ROM in rest of the upper extremity was satisfying.

In the muscle length test he has shortness in all the four tested upper extremity muscles, most markedly on the right side.

Examination of basic movement patterns showed that he is using accessory muscles instead of the prime movers, especially in shoulder abduction where he is using upper part of trapezius to perform the movement. It is worst on the left side. In neck flexion he is using trunk muscles to assist the movement. When he performed the push-ups he felt tired after only 3 repetitions, and I could see clearly that his left arm was weaker. All the movements showed altered movement patterns.

The neurologic examination did not show any pathological findings.

In the muscle strength test only the triceps together with anconeus was weakened, but it was expected since he has C7 syndrome. It was tested to grade 4 according Kendall.

Examination against isometric resistance of rotator cuff muscles according Cyriax did not give any painful results.

During the palpation of muscles I found hypertone in upper trapezius, supraspinatus subscapularis, upper paravertebrals, pectoralis major and pectorlis minor on the left side in addition with hypotone of triceps and biceps. On the right side I found hypertone in lower paravertebrals and deltoid. The most critical findings of palpation were in the soft tissues, where I found stiff and tight fascia of the neck and upper back.

In the joint play examination I found restricted movement in 3rd, 4th and 5th thoracic vertebrae, in direction of extension.

He has lower thoracic breathing pattern with small activity of the abdominal muscles.

To conclude the initial examination is all his main problems situated in the area of neck and upper extremity. The rehabilitation plan will be conducted according to these findings.

3.4 Rehabilitation plan

Short term rehabilitation plan

- Relieve acute pain (make him able to sleep through the night)
- Centralization of pain
- Improve breathing pattern → activate abdominals
- Increase ROM in neck
- Strengthen triceps and anconeus
- Release fascia of neck and upper back
- Relax upper part of trapezius
- Correct posture (sitting and standing)
- Educate exercises for self therapy

Long term rehabilitation plan

- Relieve chronic pain
- Regain optimal ROM in neck
- Stabilize the neck
- Sensomotoric exercises

3.5 Therapy Progress

Day to day therapy – Day 1

Date: 17.01.13 Time: 15.45

Status before therapy

Since this was the first day we met, and we did all the examinations, the patient is quite tired. We are going to have a short therapy session.

Goal of today's therapy unit

- Increase extension in neck
- Find suitable self therapy

Therapy implementation

- Exercises according to McKenzie (in cooperation with supervisor) (32):
  - Lateral flexion of neck
  - Flexion of neck
  - Extension of neck (until pain)
  - Rotation of neck
  - Retraction of neck (retroflexion)
  - Protraction of neck

10 repetitions

Result

Subjective:

The exercises produced some pain in the beginning (burning pain in the area of axilla and scapula – pain scale: 2). After a few repetitions he felt better, no pain but tension.

Objective:

He had a slight increase of extension in the neck (2-3 degrees). The muscles produced big tension (big activity of the tendons). Shortness of the muscles limits the movements.

Self therapy

- 5-10 repetitions of protraction according McKenzie when he feels the pain during the night.

Day to day therapy – Day 2

Date: 18.01.13 Time: 14.15

Status before therapy

He did not sleep very well this night, he got up and walked, and it immediately decreased the pain. He did the protraction exercise and he felt better afterwards.

Goal of today's therapy unit

- Relax soft tissues of neck and upper back
- Strengthen triceps

Therapy implementation

- Soft tissue technique
  - Rolling with soft ball
  - Kibler's fold
  - Stroking
  - Trapezius wave
  - Fascia release
- Isometric contraction of triceps using overball (pushing down)
- PNF:
  - 1st diagonal flexion pattern (for ROM)
  - 1st diagonal extension pattern (hold-relax-active movement – strengthen triceps)
- Exercises according McKenzie (in cooperation with supervisor) (32):
  - Active lateral flexion
  - Passive lateral flexion

Result

Subjective:

He felt improvement after the therapies that we did today. He especially felt better after the soft tissue technique, he felt really relaxed afterwards. He had no pain during the pressing of overball or the PNF technique. When he did the McKenzie exercise he felt a

painful twitch in the area of axilla when he moved back to neutral position, but after a few repetitions the pain decreased.

Objective:

He tolerated the therapy implementation well. After the soft tissue technique I could feel release of the fascia, he was softer in the upper part of back, but still hard in the area of the left trapezius. During the overball exercise he was able to do it, but was a little shaky when he was at the end range of the motion. When he performed the PNF he was able to perform the patterns correctly. In the 1st diagonal flexion pattern he elevated his shoulder during all the repetitions, so we have to find a way to relax the trapezius muscle. After the McKenzie exercises he improved ROM by a few degrees.

<u>Self therapy</u>

- Active lateral flexion
- Exercise PNF patterns (5-10 repetitions for 2-3 times)
- Push with the arm to the madras (like he did with the overball)

Day to day therapy – Day 3

Date: 21.01.13 Time: 14.30

Status before therapy

He slept well this night, 4-5 hours. He is in no pain today; they changed content of infusion on Saturday (see pharmacological history in anamnesis). He has no pain when performing extension of neck but slight paresthesia to the left forearm. He did the self exercises during the weekend and can feel improvement.

Goal of today's therapy unit

- Increase extension using traction
- Improve breathing pattern
- Relaxation of upper trapezius

Therapy implementation

- Therapy according McKenzie (in cooperation with supervisor):
  - Retraction
  - Unspecific mobilization into retraction
  - Traction into extension
  - Tractionin to retraction – extension
  - Traction into retraction
- Soft tissue techniques
- Isometric contraction of triceps using overball (10 rep x 3)
- Shoulder exercises (10 rep)
  - Horizontal ABD + ER
  - Flexion
- PNF (5 rep)
  - 1st diagonal flexion pattern (for ROM)
  - 1st diagonal extension pattern (hold-relax-active movement – strengthen triceps)
- Localized brathing
- Relaxation of trapezius (10 reps of both exercises)
  - Rolling of shoulders with resistance

- Rolling of shoulders with hands above head with resistance

Result

Subjective:

He could feel the triceps getting stronger and he feels improvement from the PNF exercise. He also felt really improvement of the extension in neck after the tractions.

Objective:

The soft tissues are softer than last session and the trapezius is not so tense. The Kibler's fold was easier to provide.

His triceps strength has increased to grade 5- according Kendall. I can barely see some shaking when he is pushing the ball down. He has improved ROM in his shoulder by the active exercises and the PNF. The relaxation exercise for trapezius is really effective, and by aspection I could see that his left shoulder is slightly getting more depressed. In the brathing wave I was able to get him to activate the abdominals more so the breathing pattern is more fluent. The tractions were very successful; we could clearly see improvement in range of extension.

Self therapy

- Active lateral flexion and retraction
- Exercise PNF patterns (5-10 repetitions for 2-3 times)
- Push with the arm to the madras (like he did with the overball)
- Rolling his shoulders forward and backward

Day to day therapy – Day 4

Date: 22.01.13 Time: 14.15

Status before therapy

He is feeling really good today. He slept through the whole night without pain. He did the exercises and it makes him more relaxed afterwards. He has slight pain in his scapula and axilla.

Goal of today's therapy unit

- Increase extension in neck
- Releaxation of trapezius
- Correction of sitting posture
- General conditioning

Therapy implementation

- Therapy according McKenzie (in cooperation with supervisor):
    - Retraction
    - Unspecific mobilization into retraction
    - Traction into extension
    - Tractionin to retraction – extension
    - Traction into retraction
- Soft tissue techniques
- Isometric contraction of triceps using overball (10 rep x 3)
- Shoulder exercises (10 rep)
    - Horizontal ABD + ER
    - Flexion
    - Making circles with crossed arms – forward
    - Making circles with crossed arms - upward
- PNF (5 rep)
    - 1st diagonal flexion pattern
    - 1st diagonal extension pattern (hold-relax-active movement)
    - 2nd diagonal flexion pattern
    - 2nd diagonal extension pattern

- Localized breathing
- Relaxation of trapezius (10 reps of both exercises)
    - Rolling of shoulders with resistance
    - Rolling of shoulders with hands above head with resistance
- Correction of sitting posture
- Active motions of neck:
    - Rotations
    - Lateral flexion
    - Extension

Result

Subjective:

During the shoulder exercises he felt slight pain in horizontal ABD + ER. When he did the exercises with crossed arms forward he felt slight pain when he moved to the left side. Performing active motions of the neck he felt slight pain and tension (Pain scale: 2) during lateral flexion and rotation to the left side. Otherwise he felt the therapy session went well.

Objective:

He is improving every day. He manages to do the exercises well even though he has slight pain in some directions. He has increased ROM in neck and shoulders. And his strength in triceps can be considered 5 now. He is still a little stiff and tensed in his trapezius, but we will continue to decrease the tension tomorrow.

Self therapy

- Active lateral flexion and retraction
- Exercise PNF patterns (5-10 repetitions for 2-3 times)
- Push with the arm to the madras (like he did with the overball)
- Rolling his shoulders forward and backward
- Correction of sitting posture (5 times)

Day to day therapy – Day 5

Date: 23.01.13 Time: 8.15

Status before therapy

He is going home today, therefore the therapy session and final kinesiological examination is early in the morning.

He is in good condition and no pain. He slept through the whole night, and he has no pain in scapula or axilla. When he did the self exercises he felt slight pain (Pain scale: 2) in the beginning, but it stopped. He feels only slight pain in the end range of extension in neck.

He feels 70 % better since the first therapy session, he can lie on his back during sleep and the pain is more centralized.

Goal of today's therapy unit

- General conditioning
- Instruct self exercises to do when he get home

Therapy implementation

- Soft tissue techniques
- Isometric contraction of triceps using overball (10 rep x 3)
- Shoulder exercises (10 rep)
    - Horizontal ABD + ER
    - Flexion
    - Making circles with crossed arms – forward
    - Making circles with crossed arms - upward
- PNF (5 rep)
    - 1st diagonal flexion pattern
    - 1st diagonal extension pattern (hold-relax-active movement)
    - 2nd diagonal flexion pattern
    - 2nd diagonal extension pattern
- Breathing exercise → "Breath under my hands" – make breathing wave
- Relaxation of trapezius (10 reps of both exercises)

        - Rolling of shoulders with resistance
        - Rolling of shoulders with hands above head with resistance
- Correction of sitting posture
- Active motions of neck:
        - Rotations
        - Lateral flexion
        - Extension

Result

Subjective:

He feels good, and he told me that my therapy implementation was the reason that he has improved so much. He was very thankful. He said that it would be good to come home, and that he will continue to do some of the exercises.

Objective:

He has showed great improvement since the first therapy session. His soft tissues are almost fully relaxed, including the trapezius. Triceps has improved from grade 4 to 5 and his ROM in shoulder is nearly perfect.

Self therapy

- Correction of sitting posture
- Retraction according McKenzie
- PNF patterns
- Rolling of shoulders

3.6 Final Kinesiologic examination

Examinations were performed 23.01.13

Changes from initial examination is marked in green

3.6.1 Posture examination

Posterior view

- Narrow stance
- ER of legs – more on the right side
- Popliteal line is higher on right side
- Atrophy of gluteals
- **Thoracobrachial angle is symmetrical**
- Left scapula is more prominent (dorsal winging)
- The shoulders are broader than the hip
- Elbows are flexed

Lateral view – right

- **Slight frontal loading of lower extremity**
- Normal extension of knees
- Slight hyperlordosis of lumbar spine
- Big kyphosis of thoracic spine – extends all the way to C/Th-crossing
- Sligth lordosis of cervical spine
- **Retraction of shoulders**
- **Slight forward head position**
- Slight flexion of head

Lateral view – left

- Confirmation of the right side

Anterior view

- Physiologic arches – longitudinal and transversal
- Hallux valgus on both feet, bigger on left
- **Slightly more loading on left foot**

- **Body is in midline**
- **Left shoulder is slightly higher**
- **Head slightly rotated to the left side**

3.6.2 Gait examination

- **Slight clasping of feet**
- **Longer stance**
- **Slight extension of knees**
- ER of feet
- **Left arm swings slightly more**
- **Right arm is positioned out from body**
- **Slight movement of trunk**
- **Midline position of upper extremities**

3.6.3 Pelvis examination

Crista: **Same on both sides**

PSIS: **Same on both sides**

ASIS: **Same on both sides**

Result: **Normal shift of pelvis**

3.6.4 Spine distances

Flesch de Forestier: **8 cm**

Cepoj's distance: **3,5cm** – physiological

3.6.5 Range of motion – active motion for orientation

Cervical spine

Motion	**Result**
Flexion	Chin on breast, no pain
Extension	**No pain, 35°**
Lateral flexion - left	No pain, 35°
Lateral flexion - right	No pain, **35°**
Rotation left	**Feels slight tension around the whole neck, 35°**
Rotation right	**Feels slight tension around whole neck, 35°**

Table 17

Shoulder joint

Motion	Result right	Result left
Abduction	**175°**	**180°**
Adduction	0°	0°
Flexion	**180°**	**180°**
Extension	40°	40°
External rotation	35°	**35°**
Internal rotation	Able to do it – hand on ribs	Able to do it –hand on ribs

Table 18

All movements were performed in sitting position except extension (standing), because the patient's pain worsens in lying position.

Elbow joint

Motion	Result right	Result left
Flexion	135°	135°
Extension	0°	0°
Supination	90°	90°
Pronation	90°	90°

Table 19

Wrist joint

Motion	Result right	Result left
Dorsiflexion	70°	70°
Palmarflexion	80°	80°
Radial duction	15°	15°
Ulnar duction	30°	30°

Table 20

Functional movement of fingers

Abduction: Able to perform

Adduction: Able to perform

Flexion: Able to perform

Extension: Able to perform

Opposition: Able to perform between thumb and all 4 fingers

Lumbricales: Able to perform

3.6.6 Muscle length test according Janda (30)

Tested muscle	Grade right	Grade left
Levator Scapulae	**1**	1
Sternocleidomastoid	**1**	**1**
Scalene	**1**	1
Cervical lateral flexion	**1**(35°)	1 (35°)

Table 21

3.6.7 Examination of basic movement patterns according Janda (27)

Movement pattern	Result
Shoulder abduction	No pain. Performed motion until 90° with elbows in 90° flexion. **Upper trapezius is less active.** No lateral flexion of the trunk during movement. Symmetrical range of motion.
Neck flexion	No pain**. Motion is more fluent. He is not using accessory muscles so much. Shortness is still present, but not so big activity of tendons.**
Push up	No pain, but it is still tiring to perform. **Both arms work symmetrical. Left scapula is still more prominent than right, but not so much as it was in the initial examination.**

Table 22

3.6.8 Neurologic examination

Dermatome sensation

Touched area	Result
C3 – Supraclavicular fossa	Same on both sides
C4 – Acromioclavicular joint	Same on both sides
C5 – Lateral antecubital fossa	Same on both sides
C6 – Thumb	Same on both sides
C8 – Little finger	Same on both sides

Th1 – Medial antecubital fossa	Same on both sides
Th2 – Apex of Axilla	Same on both sides
Th3 – Midclavicular line	Same on both sides
Th4 – Level of nipples	Same on both sides
Th5 – Level of xiphoid process	Same on both sides

Table 23

Test of deep tendon reflexes

Reflex	Grade right	Grade left
C5/C6 - Biceps	2	2
C7 - Triceps	2	2
C8 - Flexors	2	2

Table 24

3.6.9 Muscle strength testing according Kendall of C7 root muscles

Tested muscle	Grade right	Grade left
Brachialis (with biceps brachii)	5	5
Coracobrachialis	5	5
Serratus Anterior	5	5
Teres Major	5	5
Pectoralis Major	5	5
Pectoralis Minor	5	5
Extensor Carpi Radialis Longus	5	5
Flexor Carpi Radialis	5	5
Flexor Carpi Ulnaris	5	5
Pronator Teres	5	5
Supinator	5	5
Latissimus Dorsi	5	5
Triceps Brachii + Anconeus	5	5
Abductor Pollicis Longus	5	5
Extensor Digitorum	5	5
Extensor Digiti Minimi	5	5
Extensor Indicis	5	5
Extensor Pollicis Longus	5	5

Extensor Pollicis Brevis	5	5
Flexor Pollicis longus	5	5
Palmaris Longus	5	5
Pronator Quadratus	5	5
Extensor Carpi Radialis Longus	5	5
Extensor Carpi Radialis Brevis	5	5

Table 25

3.6.10 Examination against isometric resistance of rotator cuff according Cyriax

Movement	**Result right**	**Result left**
Against ABD	No pain	No pain
Against raising of semiflexed arm	No pain	No pain
Against ER	No pain	No pain
AgainstIR	No pain	No pain

Table 26

3.6. 11 Palpation

Muscles

Muscle	**Result right**	**Result left**
Upper trapezius	Normal	**Slight hypertone***
Supraspinatus	Normal	**Slight hypertone**
Infraspinatus	Normal	Normal
Subscapularis	Normal	**Normal**
Paravertebral upper	Normal	**Slight hypertone**
Paravertebral middle	Normal	Normal
Paravertebral lower	Hypertone	Normal
Pectoralis major	Normal	**Normal**
Pectoralis minor	Normal	**Normal**
Deltoid	Hypertone	Normal
Triceps	Normal	**Normal**
Biceps	Normal	**Normal**

Table 27

*= Triggerpoint

Skin and fascia

Skin-drag test:

- **Slight restricted in left upper trapezius**

Kibler's fold

- **Slight restriction in left upper trapezius**

Palpation of fascia of the neck

- **Fascia moves symmetrical in both directions**

3.6.12 Examination of joint play according Lewit

Joint	**Result right**	**Result left**
1st rib (springing to opposite hip)	No blockage	No blockage
2nd rib (overtake phenomenon)	No blockage	No blockage
3rd rib (overtake phenomenon)	No blockage	No blockage
4th rib (overtake phenomenon)	No blockage	No blockage
5th rib (overtake phenomenon)	No blockage	No blockage
6th rib (side-bending in insp + exp)	No blockage	No blockage
7th rib (side-bending in insp + exp)	No blockage	No blockage
8th rib (side-bending in insp + exp)	No blockage	No blockage
9th rib (side-bending in insp + exp)	No blockage	No blockage
10th rib (side-bending in insp + exp)	No blockage	No blockage
11th rib (side-bending in insp + exp)	No blockage	No blockage
12th rib (side-bending in insp + exp)	No blockage	No blockage
Acromioclavicular: cranio -caudal	No blockage	No blockage
Acromioclavicular: ventro-dorsal	No blockage	No blockage
Atlantooccipital : Lateral flexion	No blockage	No blockage
Scapula – circular movement*	Movable	Movable
Scapula – ABD + elevation*	Movable	Movable
C/Th – Cross: ventro-dorsal (sitting)	No blockage	No blockage
C/Th – Cross: latero-lateral (sitting)	No blockage	No blockage
1st Thoracic (Flexion and extension)	No blockage	No blockage
2nd Thoracic (Flexion and extension)	No blockage	No blockage

3rd Thoracic (Flexion and extension)	**No blockage**	**No blockage**
4th Thoracic (Flexion and extension)	**No blockage**	**No blockage**
5th Thoracic (Flexion and extension)	**No blockage**	**No blockage**
6th Thoracic (Flexion and extension)	No blockage	No blockage
7th Thoracic (Flexion and extension)	No blockage	No blockage
8th Thoracic (Flexion and extension)	No blockage	No blockage
9th Thoracic (Flexion and extension)	No blockage	No blockage
10th Thoracic (Flexion and extension)	No blockage	No blockage
11th Thoracic (Flexion and extension)	No blockage	No blockage
12th Thoracic (Flexion and extension)	No blockage	No blockage

Table 28

*Testing the mobility of scapula against thorax

3.6.13 Examination of breathing pattern

- Lower thoracic breathing → ribs flare out
- **Better activity of the abdominals**
- 14 breaths per minute

1.7 Evaluation of the effect of the therapy

Comparison of initial and final examination in relation to rehabilitation plan

Initial Examination	Final Examination
Posture Examination Posterior view - Narrow stance - ER of legs – more on the right side - Popliteal line is higher on right side - Atrophy of gluteals - Thoracobrachial angle is bigger on left side - Left scapula is more prominent (dorsal winging) - The shoulders are broader than the hip - Elbows are flexed Lateral view – right - Frontal loading of lower extremity - Normal extension of knees - Slight hyperlordosis of lumbar spine - Big kyphosis of thoracic spine – extends all the way to C/Th-crossing - Sligth lordosis of cervical spine - Protraction of shoulders - Forward head position - Slight flexion of head Lateral view – left - Confirmation of the right side	**Posture examination** Posterior view - Narrow stance - ER of legs – more on the right side - Popliteal line is higher on right side - Atrophy of gluteals - **Thoracobrachial angle is symmetrical** - Left scapula is more prominent (dorsal winging) - The shoulders are broader than the hip - Elbows are flexed Lateral view – right - **Slight frontal loading of lower extremity** - Normal extension of knees - Slight hyperlordosis of lumbar spine - Big kyphosis of thoracic spine – extends all the way to C/Th-crossing - Sligth lordosis of cervical spine - **Retraction of shoulders** - **Slight forward head position** - Slight flexion of head Lateral view – left - Confirmation of the right side

<table>
<tr>
<td>Anterior view
- Physiologic arches – longitudinal and transversal
- Hallux valgus on both feet, bigger on left
- More loading on left foot
- Body shifted to the left side
- Left shoulder is higher
- Head rotated to the left side</td>
<td>Anterior view
- Physiologic arches – longitudinal and transversal
- Hallux valgus on both feet, bigger on left
- Slightly more loading on left foot
- Body is in midline
- Left shoulder is slightly higher
- Head slightly rotated to the left side</td>
</tr>
<tr>
<td>Gait examination
- Clasps feet – no physiological unroll
- Short stance
- No extension of legs
- ER of feet
- Left arm swings more
- Right arm is close to the body
- Stiff trunk
- Frontal position of both upper extremities</td>
<td>Gait examination
- Slight clasping of feet
- Longer stance
- Slight extension of knees
- ER of feet
- Left arm swings slightly more
- Right arm is positioned out from body
- Slight movement of trunk
- Midline position of upper extremities</td>
</tr>
<tr>
<td>ROM in neck
<table><tr><th>Motion</th><th>Left</th><th>Right</th></tr><tr><td>F</td><td colspan="2">Chin on breast</td></tr><tr><td>E</td><td colspan="2">20°, painfull</td></tr><tr><td>LF</td><td>35°</td><td>30°</td></tr><tr><td>Rotation</td><td>25°</td><td>25°</td></tr></table></td>
<td>ROM in neck
<table><tr><th>Motion</th><th>Left</th><th>Right</th></tr><tr><td>F</td><td colspan="2">Chin on breast</td></tr><tr><td>E</td><td colspan="2">35°, no pain</td></tr><tr><td>LF</td><td>35°</td><td>35°</td></tr><tr><td>Rotation</td><td>35°</td><td>35°</td></tr></table></td>
</tr>
<tr>
<td>Spine distances
Flesch de Forestier: 9,5 cm
Cepoj’s distance: 3cm – physiological</td>
<td>Spine distances
Flesch de Forestier: 8 cm
Cepoj’s distance: 3,5cm – physiological</td>
</tr>
</table>

Basic movement patterns Shoulder ABD: No pain. Performed motion until 90° with elbows in 90° flexion. Upper part of trapezius acts as a prime mover, especially on the left side. No lateral flexion of the trunk during movement. Symmetrical range of motion. Neck flexion: No pain, but he felt tension in the area of axilla and scapula on the left side during movement. He is able to put the chin on his breast. He is using accessory trunk muscles to perform the flexion, his whole thorax is moving in cranial direction and his ribs are flaring outwards. He shakes his head during the motion and there is big tension (prominent tendons) of his sternocleidomastoid muscle. Push-up: No pain, but it felt tiring after 3 repetitions. He has more activity/strength of his right arm, it depresses and elevates before the left one. His left scapula is more prominent (winging)	**Basic movement patterns** Soulder ABD: No pain. Performed motion until 90° with elbows in 90° flexion. **Upper trapezius is less active.** No lateral flexion of the trunk during movement. Symmetrical range of motion. Neck Flexion: No pain**. Motion is more fluent. He is not using accessory muscles so much. Shortness is still present, but not so big activity of tendons.** Push-up: No pain, but it is still tiring to perform. **Both arms work symmetrical. Left scapula is still more prominent than right, but not so much as it was in the initial examination.**
Muscle strength test acc. Kendall Triceps + anconeus: 4	**Muscle strength test acc. Kendall** Triceps + anconeus: **5**
Examination of Join play acc. Lewit 3rd Thoracic (Flexion and extension): Restricted to extension 4th Thoracic (Flexion and extension): Restricted to extension 5th Thoracic (Flexion and extension): Restricted to extension	**Examination of Joint play acc. Lewit** 3rd Thoracic (Flexion and extension): **No blockage** 4th Thoracic (Flexion and extension): **No blockage** 5th Thoracic (Flexion and extension): **No blockage**
Palpation of skin and fascia Skin-drag test: - Tight skin in the upper part of	**Palpation of skin and fascia** Skin-drag test: - **Slight restricted in left upper**

back and neck on the left side Kibler's fold - Tight fascia in the whole area of upper back en neck, but worse on the left side Palpation of fascia of the neck - Fascia is more restricted in the left direction	**trapezius** Kibler's fold - **Slight restriction in left upper trapezius** Palpation of fascia of the neck - **Fascia moves symmetrical in both directions**
Examination of breathing pattern - Lower thoracic breathing → ribs flare out - Small activity of the abdominals - 14 breaths per minute	**Examination of breathing pattern** - Lower thoracic breathing → ribs flare out - **Better activity of the abdominals** - 14 breaths per minute

Table 29

The results above show that the applied therapy was successful and beneficial for the patient. Cervicobrachial syndrome is a diffuse diagnosis, but in his case the symptoms were clear and therefore also the goal of the therapy approach. McKenzie method is an efficient therapy for this kind of diagnosis, especially for the neck pain, which was his main problem. Due to his excruciating pain I chose not to do mobilization of the cervical spine. In addition his pain increased when lying down, so I tried not to have him in lying position for a longer period of time. PNF and strengthening exercise with overball was shown to be effective for the weakened triceps, and the soft tissue techniques were much needed for his neck an upper back. In addition I focused on correcting his posture, both in sitting and standing, because I think his poor posture may have contributed to his problems.

The patient was very motivated and cooperated very nicely in regard to understanding the therapies and ability to perform the movements which was necessary. He also did autotherapy between each session, which improved especially his weakened triceps. He responded well to all the therapies which was performed and showed improvement after each therapy session. In five therapy sessions I managed to do big improvements, whereas the biggest one is decreasing and centralization of his pain. When he first came his pain was 10 out 10, and on the last day he had only 2 on the pain scale. In relation to ADL his only problem was that he

was not able to sleep through the whole night, and that he could not lie on his back or left side. The last night at the hospital he slept through the whole night, and he was able to lie on his back and both sides. I think this was the most important improvement for him, since sleeping is a part of the everyday-routine and therefore important for his comfort.

Despite the measured and subjective improvements, I don't think he will reach full recovery. He has degenerative changes in his cervical spine which conservative treatment will not be able to decrease. But as long as he stays out of pain, and is able to live a functional life, I don't think surgery is necessary for him. If I had more time with him, I would focus a little more on stabilization of his cervical spine by use of sensomotoric exercises.

4. Conclusion

I was first introduced to may patient on my 4th day of practice at UVN. I chose him because it was his 2nd day of hospitalization, but first day of applied therapy, which gave me a perfect opportunity to see improvements and progression from the beginning. We had 5 sessions together during my practice. Despite some communication problems due to the language barrier, we were able to cooperate quite well. I was able to use a lot of the examinations and therapies that we learned at school, in addition to some new techniques my supervisor introduced me to.

It has been a great learning experience to work with this case study. I have learned a lot about the examination and therapy regarding the cervical spine, and how problems in that area can influence the rest of the body. I have collected relevant theory and information about the cervicobrachial syndrome including useful therapeutic approaches which were performed on the patient and lead to satisfactory results. The most useful learning experience was to follow the patient from initial examination and until we reached functional improvements.

I think the prognosis of the patient is good. He is able to perform all ADL and live a healthy functional life according his current functional abilities. He will probably not be able to regain full ROM in his neck ever again due to his degenerative changes. In that case that it will be possible, surgery is needed. In relation to his age, he is in good shape, and as long as he keeps up his activity level, he has many good years in front of him.

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6 Supplement

6.1 List of tables

List of figures

Figure 1: **painneck.com.** Cervical Spinal Nerves. January 22, 2011. http://www.painneck.com/cervical-nerves.

Figure 2 & 3: **Lauder, Tamara D.** Musculoskeletal disorders that frequently mimic radiculopathy. *Mayo Medical School.* 2002. www.med.nyu.edu.

Figure 4, 6 & 7: **Garfin, Steven R. and Bono, Christopher M.** Cervical Spondylosis: Patient History and Case. *Spineuniverse.* September 9, 2012. http://www.spineuniverse.com/conditions/spondylosis/cervical-spondylosis-patient-history-case.

Figure 5: **SpineCare.** Cervical Spondylosis/Arthritis. [Online] [Cited: April 17, 2013.] http://www.visitspinecare.com/conditions/neck/cervical-spondylosis--arthritis/.

Figure 8: Excerpt from patient's health documentation

6.3 List of Abbreviations

ABD = Abduction

ADL = Activities of daily living

ASIS = Anterior superior iliac spine

BF = Breathing frequency

BMI = Body mass index

BP = Blood pressure

C = Cervical, e.g. C1 = 1st cervical vertebra

Cm = Centimeter

CT = Computer tomography

C/Th-crossing = Cervical/Thoracic crossing

E = Extension

E.g. = Exempli gratia = for sake of example = for example

ER = External rotation

Exp = Expiration

F = Flexion

FTVS = Fakulta Telesne Vychovy a Sportu

HR = Heart rate

Insp = Inspiration

IR = Internal rotation

Kg = Kilogram

PNF = Proprioceptive neuromuscular fascilitation

PSIS = Posterior superior iliac spine

Rep = Repetitions

ROM = Range of motion

Th = Thoracic, e.g. Th1 = 1st thoracic vertebra

UVN = Ústřední Vojenská Nemocnice

6.4 Informed Consent form

INFORMOVANÝ SOUHLAS

V souladu se Zákonem o péci o zdraví lidu (§ 23 odst. 2 zákona c.20/1966 Sb.) a Úmluvou o lidských právech a biomedicíne c. 96/2001, Vás žádám o souhlas k vyšetrení a následné terapii. Dále Vás žádám o souhlas k nahlížení do Vaší dokumentace osobou získávající zpusobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uverejnením výsledku terapie v rámci bakalárské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

Dnešního dne jsem byla odborným pracovníkem poucena o plánovaném vyšetrení a následné terapii. Prohlašuji a svým dále uvedeným vlastnorucním podpisem potvrzuji, že odborný pracovník, který mi poskytl poucení, mi osobne vysvetlil vše, co je obsahem tohoto písemného informovaného souhlasu, a mela jsem možnost klást mu otázky, na které mi rádne odpovedel.

Prohlašuji, že jsem shora uvedenému poucení plne porozumela a výslovne souhlasím s provedením vyšetrení a následnou terapií. Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uverejnením výsledku terapie v rámci studie.

Datum:.....

Osoba, která provedla poucení:.....

Podpis osoby, která provedla poucení:.....

Vlastnorucní podpis pacienta /tky:.....

6.5 Approved application for Ethics Board Review

CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
José Martího 31, 162 52 Praha 6-Veleslavín
tel. +420 2 2017 1111
http://www.ftvs.cuni.cz/

Application for Ethics Board Review

of the undergraduate research, involving human subjects

Project title: Case study of a patient with the diagnosis Cervicobrachial Syndrome

Nature of the research project: Bachelor Thesis

Author (chief investigator): Silje Solbakken Syversen

Supervisor (in case of student research): Agnieszka Dudova

Research project description: Case study of a patient with the diagnosis Cervicobrachial Syndrome will be conducted under the expert supervision of an experienced physiotherapist at Ustredni Vojenska Nemocnice..
Guaranteed safety to be judged by experts:
No invasive methods will be used
Ethical aspects of the research:
Personal data obtained during the investigation will not be published. **Informed consent** (attached)

Date: 29/1-13 Author's signature: Silje S. Syversen

Faculty of Physical Education and Sport, Charles University in Prague
ETHICS BOARD REVIEW

Ethics Board members: Doc. MUDr. Staša Bartůňková, CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.
Approval number: 047/2013
Date: 29.1.2013

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and **found no contradictions with valid principles**, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

Bartůňková
Signature, REB Chairman

Official school stamp

UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6

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