An Anatomical Insight into the Biomechanics of Cobra Posture

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Abstract:
The science of yoga deals with various yogic postures and their beneficial effects on the practicing subjects. This review has tried to highlight the benefits of one of the favorites of the yoga practitioners, the Cobra Posture (CP). The pragmatic utility of the CP can be enhanced by incorporating the correct and justifiable anatomical insight into the joints and muscles involved. An accurate practice of the CP shall be tremendously helpful in relieving the stress and strain which the neck and spine areas bear in this present day world, where prolonged hours of sitting on the desk or slouching is done for a considerable period of time.

Key words: Cobra posture, Cobra pose, spine, yogasanas

Introduction
The biomechanics behind various yogic postures and their effects on the neuromuscular system is stated to be the fundamental aspect of the science of Yoga. A sound knowledge of anatomy of different yogic postures is of profound help to the students, yoga experts and researchers, who can attain the maximum possible results in their practice of yoga. Yoga in general has been proven by many studies to increase the range of motion (ROM) in joints. The application of biomechanics can be subdivided into two major thrust areas. Firstly, it is the enhancement and improvisation of the performance of various postures in yoga. Secondly, it assumes importance in the decline in the incidence of injuries related to the practice of yoga.

It is with this notion that the present review highlights the correct methodology and facts related to the Cobra Posture (CP) with an amalgamation of the basic anatomical facts related to the same. The CP is actually the back bending posture, which is said to be one of the most energetic and exhilarating member of the yogasanas group. Many individuals have the anatomy of the upper back as rounded and the chest area closed. This is attributed to the present day lifestyle jobs and work culture, where a person, often due to prolonged hours of sitting along with a slouching posture on a desk, is on a high risk of developing posture injuries and pain symptoms. Poor postural positions result in restricting the front of the body and exaggerating the effects by means of shallow breathing. Ultimately this has a negative impact on the general well being of the person that also culminates in a reduced work performance on account of exhaustion of energy levels. Thus, incorporating CP in one's practice of yoga allows and favours the thoracic cage to expand, besides enhancing flexibility of the vertebral column. All these practices also help in developing the strength of the lower back as well. This is a great asana for people who tend to slouch.

The literal meaning of CP is “Snake”, derived from a word in Sanskrit. The benefits of the CP include developing the flexibility and strength of the entire vertebral column and increasing the tone of the buttocks and legs. This results in an enhanced circulation which finally has tremendous positive influences on the general systems of the body.
CP has a profound effect on the rise of “feeling of upliftment and elation”. The CP has the capacity to act as a natural antidepressant because it promotes and increase in energy levels, resulting in chasing away fatigue, depression and sadness. According to Gheranda Samhita, “Let the body, from navel to toes, touch the ground, the palms placed upon the ground, and raise gently the upper part of the body (from navel to head) like a snake”. The CP increases the gastric fire, thus annihilating many diseases and the process as whole leads to the “Awakening of the Kundalini”. A proper anatomical insight into the correct practice of the CP provides reliable and durable benefit to even the deep abdominal musculature too.

The present review highlights the kinesiological analysis and interpretation of the joints involved in CP, and the different angles of the joints which are involved while attempting the CP. It also highlights the prime movers muscles that are activated to result in the CP. Moreover, it also highlights the antagonistic and synergistic muscles of the CP.

**Methodology of Cobra Pose**

**Step 1** - Bring your hand under the shoulder blade with chin touching the floor and draw your shoulder down and lifting the shoulder off the grounds, hug your elbow back. (Photograph 1A, 1B)

**Step 2** - Pressing the feet on the floor and, and lift the knee slightly, then press your pubic bone on the floor to stabilize your back. (Photograph 2A, 2B)

**Step 3** - Now inhalation begins. Lift your chest against the floor, maintaining your connection through pubic bone to your leg. (Photograph No 2A, 2B)

**Note** – The main goal of CP is extension of spine and opening of chest. Take off your hand off the grounds for the moment, and replace your hand under the shoulder, squeeze the elbow and breathe into chest and exhale.

**Discussion**

The Kinesiological analysis of the CP assists to understand the ideal method of performing the same. The CP mainly works upon the vertebral column and the joints of the hip region, but other joints too are involved (Table No 1).

**Table No 1** - Showing various movements involved in CP

<table>
<thead>
<tr>
<th>S/No</th>
<th>Name of joint</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intervertebral joint</td>
<td>Extension</td>
</tr>
<tr>
<td>2</td>
<td>Hip joint</td>
<td>Extension</td>
</tr>
<tr>
<td>3</td>
<td>Knee</td>
<td>Extension</td>
</tr>
<tr>
<td>4</td>
<td>Ankle Joint</td>
<td>Plantar flexion</td>
</tr>
<tr>
<td>5</td>
<td>Glenohumeral Joint</td>
<td>External rotation</td>
</tr>
</tbody>
</table>

The extension of the spine is the most important movement of the CP. The range of movement of the spine can be further subdivided into three subsidiary movements that occur during the posture. The three movements include extension of cervical vertebra, thoracic vertebra & lumbar vertebra. Extension of lumbar vertebra is the prime movement that occurs in CP. During the extension of the lumbar vertebra, the body of the upper vertebra tilts and moves posterior, meanwhile the intervertebral disc becomes flatter posterior and thicker anterior, which results in the stretching over the anterior longitudinal ligaments. On the other hand, the posterior longitudinal ligaments are relaxed, the superior & inferior articular process become more interlocked with each other; hence the extension of the lumbar vertebra is
limited by the bony structure of the arch and the stretching of the anterior longitudinal ligaments.\textsuperscript{4}

The movement of the sacrum circulates the spinal fluid. Stretching resets the resting tension in the muscles alongside the spine, and strengthens and re-patterns the specific muscles.\textsuperscript{5} But there are certain limitations involved in the extension of the spine while performing CP. These include the articular process of the preceding and the succeeding vertebra involving the spinous processes, the anterior longitudinal ligaments and the intra-abdominal pressure of the subject performing the CP.

The next joint that is involved in performing the CP is the hip joint, where the movements take place in the transverse axis, and frontal plane. In the basic CP the knee is also extended with the hip joint extension. This influences the extension of the range (20°) of movement of the hip joint. The knee is flexed in the CP and it limits the range of hip extension by the contraction of the hamstring muscle. Further, the extension of the hip joint is increased by the anterior tilting of the pelvis due to an exaggeration of the lumbar lordosis.

Other movements which influence the CP are internal rotation and adduction of hip joint, knee extension, ankle planter flexion, glenohumeral joint external rotation, elbow extension, and forearm pronation. The muscles which limits the backward bending in the hip include quadriceps femoris, psoas, iliacus and abdominal muscles.\textsuperscript{6} Moreover, the erector spinae muscle group (iliocostalis, longissimus and spinalis) aids in the hip extension.\textsuperscript{6} Quadratus lumborum, iliocostalis lumborum, longissimus thoracis, and spinalis are all deep lower back muscles or posterior muscles originating and inserting on the spine that help with spine extension.\textsuperscript{7}

According to the anatomy of Hath Yoga, there are three muscle groups that are involved mainly in the CP; viz, neck muscles, shoulder muscles and the back muscles. The deep back muscles act as the prime movers. The role of synergists is played by the hip and thigh muscles.\textsuperscript{6} The deep back muscles involved as the prime movers include spine extensors, namely, intertransversarii, interspinalis, multifidi, spineless, semispinalis, splenius capitals and longissimus. These muscles work concentrically and create the spine extension. In addition to these, the Serratus posterior superior muscle synergizes the action of erectors muscle, which assist in the chest expansion. Moreover, the rectus abdominis and oblique muscle limit the overmobilization of the lumbar spine. The prime mover for the hip extension is hamstring muscle group, mainly semitendinosus, and semimembranosus along with the gluteus maximus muscle. In the case of weakness of the hamstring muscle, the gluteus maximus muscle does the hip extension, in which case the internal rotation and hip extension movement is lost.

Eventhough the CP is a very useful procedure which should be employed for the aforesaid mentioned benefits, but there are some limitations and obstacles that are encountered during its application. While doing this pose the pelvis may be lifted off the ground. Secondly, pain may be encountered by the subjects in the spine area. According to Iyengar, pain during the CP is due to a weak area of spine and back muscles. “Where there is a pinching feeling, that part of the spine is contracted, with the intervertebral discs rub against each other.”\textsuperscript{8} Some subjects tend to use the latissimus dorsi and other more superficial muscle because they create flexion of the upper back and also interfere the breathing by inhibiting the movement of the ribs.
Moreover, the pushing of the arm is another obstacle because it lifts the spine while the serratus anterior muscle is active, to maintain neutral position of the scapulae. This CP may not be effectively performed in cases of frozen shoulder, supraspinatus tear or supinator tightness. Many subjects may have spinal or hip inflexibility. These obstacles need to be addressed on a priority basis for effective utilization of the CP in pursuing the exercise for the benefit of all.

**Conclusion**

The biomechanics of yogic posture (CP) has the potential of benefitting the present day population but the prerequisites include the correct method employed with background knowledge of anatomy of the concerned area.

**Photograph 1A/1B**: Bring your hand under the shoulder blade with chin touching the floor and draw your shoulder down and lifting the shoulder off the grounds, hug your elbow back. (Photograph 1A, 1B)
Photograph 2A/2B : Pressing the feet on the floor and, lift the knee slightly, then press your pubic bone on the floor to stabilize your back. Now inhalation begins. Lift your chest against the floor, maintaining your connection through pubic bone to your leg.

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