

Bouvier's Maneuver

The Origin and Interpretation

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Bouvier's maneuver is critical for choosing from the plethora of surgical techniques described for claw correction. It basically tests the integrity of the extensor mechanics over the digits and guides whether a procedure to prevent hyperextension at the metacarpophalangeal (MCP) joint would be sufficient or augmentation of the extensor apparatus / correction of flexor shortening / joint contracture is needed. Though this test is well known and routinely practiced, authors' have observed controversies among the surgeons regarding its origin and interpretation and hence this review into the history and evolution of the test and to present a systematic way to interpret the test results which is very useful in decision making in claw correction surgery.

Biomechanically, the long extensors are the main extensor of the MCP joint whereas the intrinsic muscles are the main extensor of the interphalangeal (IP) joint. On the other hand, the intrinsic muscles are the main flexor at the MCP joint and the long flexors act as main flexor of the IP joints. So, with intrinsic paralysis the main flexor at the MCP joint and extensor at the IP joint is lost resulting in hyperextension at the MCP joint and flexion at the IP joints- Claw deformity (*Fig. 1*).



Fig.1- The 'claw deformity' with hyperextension at the MCP joint and flexion at the PIP joint.

The long extensors are capable of extending the IP joint in the absence of intrinsic muscles provided the MCP hyperextension is prevented. This is the principle behind most of the surgeries described for claw correction. However, if the extensor apparatus is overly stretched out (elongation of central slip which is seen in long standing cases) the long extensors will not be able to extend the IP joints- this is checked by the Bouvier's maneuver, making it an important part of examination and the decision making (Fig.2).

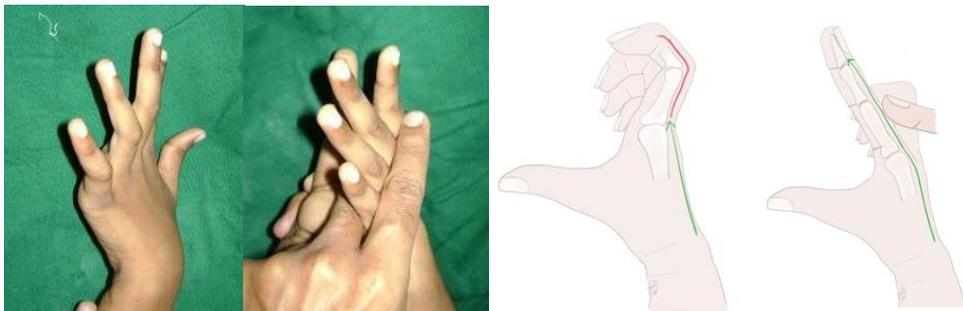


Fig.2- Prevention of the hyperextension at the MCP joint allows the long extensors to act at the PIP joint and extend them, hence, correcting the claw deformity- The Bouvier Maneuver.

There is ample of controversy about the origin of this test in the literature. The English speaking authors like Sunderland (1945), De Salamanca (1975) and others have credited Beevor (1903) for this test. Interestingly, according to certain French speaking authors it was Tubiana(1956) who first described this maneuver. However, he himself stated Beevor as its source (1975)⁽¹⁾. Bourrel in 1960 wrote that the test is described by Riordan. However, Riordan himself and Burkhalter, another doyen of tendon transfer surgery, stated that the test was described by Fowler (1973). Confusing enough!

As a matter of fact, it was Bouvier who first described the test in his publication in French in 1851⁽²⁾. The difficulty in accessing and interpreting the original French text could be one reason for the confusion in the literature about its origin. However, an attentive reader, Bourrel could easily gather that...‘It was the patient himself (Marlier Henri) who discovered this fact’⁽³⁾. To avoid confusion in parentage he suggested calling the test as- ‘The metacarpophalangeal stabilization test’⁽⁴⁾. Fair enough, but the fact is that the test has been first published by Bouvier and hence any other parentage should be avoided.

The original article (in French)⁽²⁾ details that this observation was first noted in the patient Marlier Henri, a 30 years aged carpenter, at the hospital Beaujon. ‘In the month of May after excessive work and repeated efforts to lift and to handle heavy pieces of wood he felt that the hand is losing weight and temperature seemed lowered and has become a seat of sharp pains extending from wrist to finger tips. Also, the second and third phalanges of ring and little finger half bend so as to give these fingers an arched shape which persisted on striving to extend the whole hand which could get the other fingers to complete

correctness. He could on contrary flex all the fingers thereby exaggerating the flexion of last two which was brought back to incomplete extension. However, remarkable thing was noted when the patient himself pressed with the other hand on first phalanx prevented him from obeying the action of extensors'[*Google Translated*]. The above observations clearly parallels the pathomechanics of claw hand what we now know.

The Test and Its Interpretation:

In case of paralysis of the intrinsic muscles of hand with claw deformation, the Bouvier maneuver aims to prevent MP hyperextension and to find out if active IP extension is possible through the long extensor. Patient is first asked to try to fully extend all the fingers with the wrist in neutral position (*Fig. 3a*). One would note that there is hyperextension at the MCP joint and flexion (inability to extend) at the PIP Joint (*Fig. 3a*). This angle of flexion at the PIP joint is called as '**Unassisted Angle**'. Then the examiner stabilizes the dorsal aspect of the proximal phalanx to prevent hyperextension at the MCP joint (flexes to about 10 degrees) and observes if the patient is now able to fully extend the fingers at the PIP joint(*Fig. 3b*). The angle of flexion at the PIP joint now is called as '**Assisted Angle**'.

If full extension at the PIP joint is possible after stabilizing the MCP joint, i.e. the 'Assisted angle' is zero, the maneuver is called **Positive** (*Fig.3b*). Such type of claw is called a '**Simple claw hand**'.

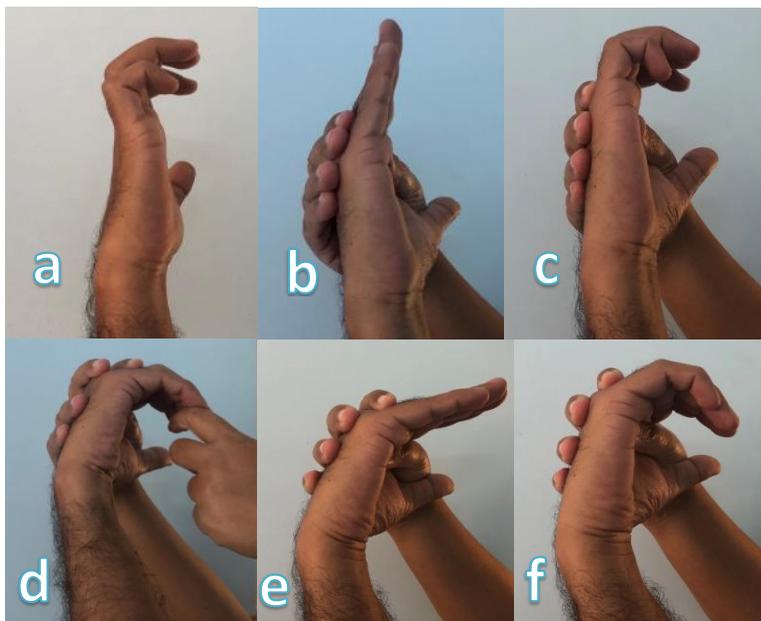


Fig. 3a-f- (a)- Showing the claw deformity and the 'Unassisted Angle';

(b)- On performing the Bouvier maneuver, the PIP joint could extend fully (Assisted angle=0)

(c)- If the PIP joint doesn't extend fully then the angle of flexion at the PIP joint is the 'Assisted Angle'. Now if passively the PIP joint can be extended it indicates an extension lag because of overstretching of the extensor mechanism;

(d)- If the PIP joint does not extend passively then one should flex the wrist to see if the finger extension is now possible

(e)- If possible- it indicates long flexor shortening and tightness;

(f)- If the PIP extension is not possible even with wrist flexed it indicates stiff PIP joint.

A positive test indicates that extensor mechanism is intact and not over stretched. In such situation, any surgical intervention (static, dynamic, semidynamic) which prevents hyperextension at the MCP joint would correct the claw. Augmentation of the extensor apparatus is not required in such cases. Hence, '**Static** operation' described for claw hand

(e.g. MCP capsulodesis and pulley advancement) could be done in such cases. These operations basically aim to prevent hyperextension at the MCP and by virtue of it they allow the long extensor to extend the PIP joint and correct the claw deformity. However, in such situations too the dynamic tendon transfers are superior to the 'static' operations as the latter tend to stretch out with time and may result in recurrence of clawing. One should choose 'static' procedures only when the tendon transfer donor availability is an issue.

The maneuver is called **Negative** when the active extension of IP joint is not possible despite the prevention of hyperextension of MCP (*Fig. 3c*). Such type of clawing is called **Complex claw hand**. The PIP joint would remain flexed in spite of the stabilization and flexion provided at the MCP joint i.e. the 'assisted angle' is not zero (*Fig. 3c*).

If the test is Negative then there could be one of the 3 possibilities:

1. The extensor mechanism in the finger is overly stretched out. This could be observed in long standing cases with elongation of central slip. This is termed as '**Passive Positive**'.
2. The long flexor tendons are shortened because of adaptive shortening over period of time. The long standing flexion posture of the fingers results in myostatic contracture of the flexor muscles and shortening of their length. This could be termed as **Passive Negative-Tenodesis positive**(*Fig. 3e*).
3. The PIP joint is stiff because of volar plate contracture or the tightness of the collateral ligaments. This could be termed as **Passive Negative-tenodesis negative or simply a stiff PIP joint**(*Fig. 3f*).

The three possibilities can be easily differentiated clinically. In situation 1, the flexion posture of the PIP joint can be easily corrected passively while performing the Bouvier's maneuver. Here, the flexed posture at the PIP joint is because of the 'extension lag' resulting from stretched extensor system. In cases with long flexor shortening, the extension of the PIP joint will be possible if the wrist is flexed while performing the test (*Fig. 3e*). However, the PIP extension will not be possible with wrist in neutral. This indicates that the long flexor are shortened and the tenodesis effect of flexing the wrist allows extra length at the PIP joint and hence the extension. If with the wrist flexion also one is unable to extend the PIP joint then it indicates that the PIP joint itself is stiff (*Fig. 3f*).

Each situation needs a special consideration and treatment plan as detailed below:

1. Extensor mechanism is overly stretched out and needs augmentation to restore PIP extension. Hence, the 'static operations' which only aim to provide MCP flexion would not work in such cases and a dynamic tendon transfer which is inserted in the extensor apparatus in order to power it up is required. Extended extensor insertion is advisable in such cases.
2. If the long flexors are shortened they can be stretched out by good physiotherapy providing stretching exercise for the long flexors and splinting in extension. At times, mild flexor tightness can be tackled at the time of surgery by performing flexor aponeurosis release or fractional lengthening.
3. A stiff PIP joint needs physiotherapy or serial casting to make the joint supple before a tendon transfer can be offered. In severe cases even surgical release may be needed but the joint should

be supplé before the tendon transfer is considered. Else, fusion of the PIP joint could be considered. Fusing the PIP joint would transfer the flexion force of the flexors to the MCP joint and would correct the claw mechanics. This option is however reserved for severe and stiff claw hands.

To conclude, **Bouvier's** maneuver, unarguably reported by Bouvier in 1851, remains an essential test for decision making in claw correction surgery. The test helps in deciding if the static claw correction procedures could be considered and also guides the point of insertion of the dynamic tendon transfer procedure chosen. The test can be systematically interpreted to help decision making as described herein.

References:

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