Case Collection

The Krukenberg Procedure: A Surgical Option for the Treatment of Bilateral Hand Amputees

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Abstract:

The concern for amputees of both hands is loss of touch, an essential sense, thereby depriving the patient of external and proprioceptive information. This sensitive function can not be replaced and no prosthesis can alleviate its absence.

The Krukenberg procedure deals with phalangising the forearm by separating the two bones of forearm thus creating a pincer like grasp that gives the patient good pinch and grip with useful sensibility.

In less developed countries where resources for sophisticated hand prosthesis are lacking, gaining a measure of self sufficiency takes precedence over the aesthetic aspect.

Introduction:

Hermann Krukenberg, a German army surgeon, developed the Krukenberg procedure in 1917. In this operation, the bones of the forearm are separated to create two forks, having a good pinch and grip with useful sensibility. Originally the target patients were soldiers injured by mines who were blind and had severe double hand injuries.

At Birendra hospital we performed this procedure on two patients.

Material and Method:

Case No. 1:

16 yrs old boy (civilian) presented with severely mangled hands (bilateral) along with neuro vascular deficit, due to blast injury on 061/12/10. He was initially managed at Janakpur Zonal Hospital. He arrived at Birendra Hospital on 061/12/11. Bilateral distal forearm amputation was done on 061/12/12. While convalescing, he was counseled about his future prospects.

a) Defunct cosmetic prosthesis or,
b) Ugly but functional forks. Pictures of patients who had undergone Krukenberg's procedure were also shown to him.

On 062/03/17 Krukenberg procedure was carried out on the right forearm and then on 062/05/02 the same procedure was performed on the left forearm. Both times general anaesthesia was used.

Case No. 2:

Figure 1: Patient showing his amputees hand

33 yrs old male serving soldier with a history of bilateral mangled hands due to blast injury on 062/3/15. Distal left forearm amputation was done on 062/3/15. Krukenberg procedure was done on left forearm on 062/6/12. He is still undergoing physiotherapy.

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Figure 2: Initial Injury of both hand (Case No. 1)

Procedure:

Longitudinal skin incisions were made on volar and dorsal aspects of forearm with a triangular flap dorsally for the web. Two musculocutaneous flaps were created. Slight deep muscle debulking was done. Pronator teres, flexor carpi radialis and extensor carpi radialis were conserved as the main adductors while brachioradialis, extensor carpi radialis longus and brevis were preserved as the main abductors. Forearm bones were separated by incising the interrosseous membrane along the ulnar side. Reconstruction was done after releasing tourniquet and achieving hemostasis. Myodesis was done at pincer tips and skin flaps closed on opposing surfaces. No skin graft was required. Post operative recovery was uneventful. Physiotherapy was initiated once the stitches were removed.

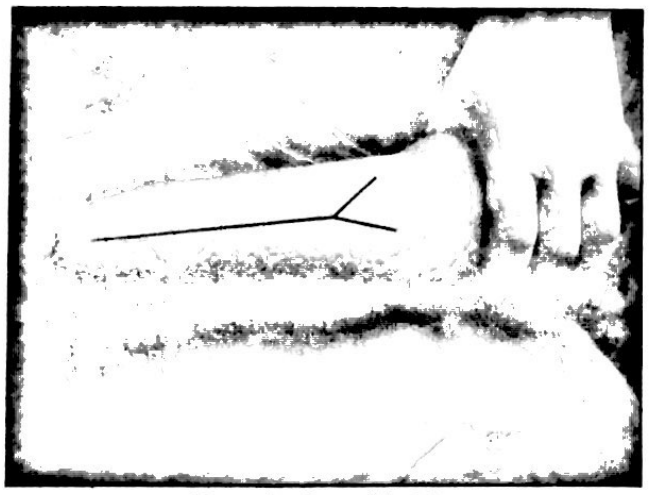

Figure 3 : Dorsal Incision

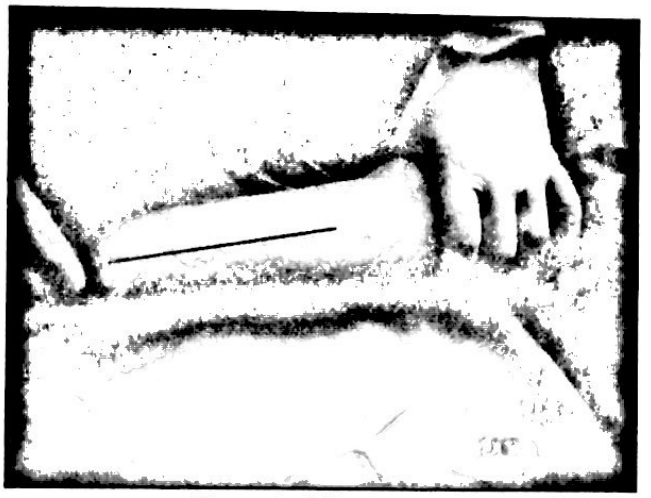

Figure 4 : Volar Incision

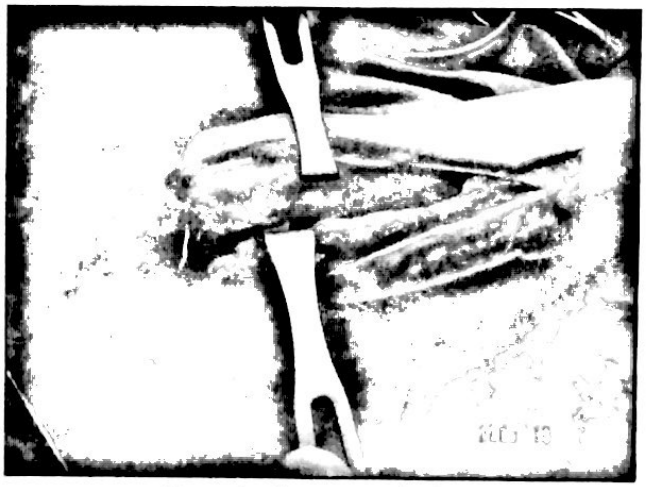

Figure 5 : Separating the forks

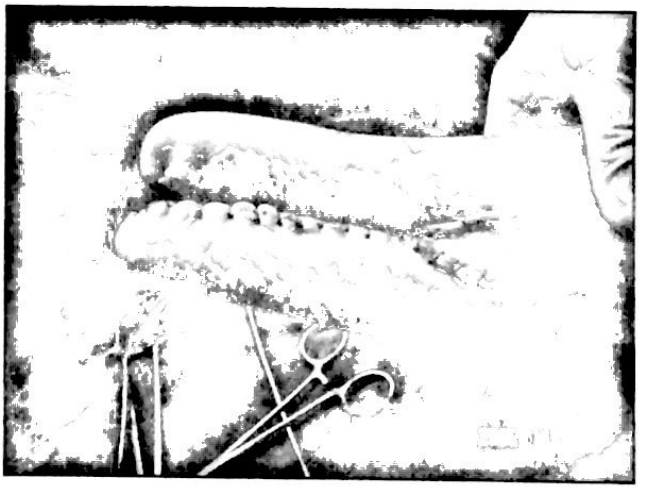

Figure 6 : Wound closed (dorsal surface)

Result:

Assessment of gripping strength and self sufficiency was done 3 months after operation. Patient was tested for grasping strength, self feeding, personal hygiene, simple dressing and manual dexterity.

A compatible measure of self sufficiency was achieved.

Figure 7 : Self feeding

Figure 8 : Writing with rt. forearm forks

Figure 9 : Writing wit lt. forearm forks

Discussion:

To be considered for Krukenberg's procedure, patients must have a remaining forearm longer than 10cm, measured from the tip of olecrenon. If done properly, the risk of functional failure is low. The operation has met with little interest mainly because of phychological rejection as the bifid forearm is ugly to look at. However, the pincer like grasp is more efficient than an articulated prosthesis or else can be covered by an artificial hand. With a prosthesis each movement must be pondered and constant sight control is required. With phalanges however, there is automatic movement. Patient develops a good sense of touch with stereognosis which allows them to function in dark.

Conclusion:

In less developed countries, where gaining a measure of self sufficiency takes precedence over the aesthetic aspect, Krukenberg procedure is a surgical option to achieve some manual dexterity in double hand amputees.

References

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