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# The Minimally Invasive Upper Extremity Surgery in Indonesia: An evolution towards a new era

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Over 150 years ago, the science and art of surgery started to advance from the basic surgical core tasks of "cutting and sewing" with hands and direct contact with the organs to a propensity towards operations with smaller surgical approaches or minimizing the surgery outright in the 21st century. This shifting paradigm considers the obvious advantages in terms of cost, patient safety, early recovery, and fewer wound-related problems like scar sensitivity and tenderness. Moreover, minimally invasive surgery (MIS) has become a demand from the patient side. No wonder patients will look for surgeons who can offer these minimally invasive services. The collaboration of innovators, engineers, industry, and patient demands resulted in a constantly developing MIS, likewise in upper extremity surgery. Minimally invasive upper extremity surgery is made even more fascinating and challenging by the variety of techniques that have been made possible by this development.

A number of MIS techniques have been applied to upper extremity surgery, such as percutaneous bone fixation, minimal incision approach for bone fixation or soft tissue release procedures, endoscopic surgery, and arthroscopic surgery (or arthroscopic assisted surgery). In addition to soft tissue procedures like percutaneous fasciotomy, percutaneous trigger finger, or minimal incision carpal tunnel release, the minimal approach techniques have also been used for bony fixation procedures like percutaneous bone fixation (k-wire, cannulated screw), and minimal incision internal fixation with plate and screw.

In Indonesia, hand and upper extremity surgery have been developed since the 1970s. The procedures done in the earlier stages were typically reconstruction and microsurgery, with trauma cases predominating. Dr. Lukman Shebubakar (1953–2020) initiated the development of modern hand surgery in Indonesia by encouraging our community to understand and master the advances in hand surgery in accordance with global advances. Thus, since 2014, the younger generation of hand surgeons has carried out that noble mission to update and modernize hand surgery in Indonesia by attending international seminars, courses, and fellowships and bringing home the knowledge and skills for patient care and continuing education for surgeons.[1]

**Figure 1.** dr. Lukman Shebubakar, father of modern hand surgery in Indonesia

Nowadays, the development of hand surgery in Indonesia covers more modern techniques to cope with the global trend, including fixation techniques, reconstruction, MIS, small joint replacement, and wide-awake hand surgery. MIS in the upper extremity has become a common practice in Indonesia and is soon to be a standard diagnosis and therapy. Numerous MIS procedures can be done in upper extremity surgery, and in the section below, we will share some procedures in our practice that have gained in number and given good results.

## Shoulder arthroscopy

The curiosity to look inside has been a natural and insatiable desire of humankind. However, closed cavities had the problem of illumination. Credit for developing the endoscope goes to certain personalities that had the desire and ability not just to look inside but to look beyond. After its first development to look inside the urinary bladder in 1806, an endoscope has been evolved to become an arthroscope. Kenji Takagi from Japan gets the credit of being the first true developer and the father of modern arthroscope that he developed from 1918 to examine the knee joint[2,3]

The spillover of knee arthroscopy into the shoulder was inevitable and began in 1980's. Shoulder arthroscopy started with instability repair, followed by subacromial decompression. Through the 1980's and 1990's, with the development in biotechnology, more sophisticated tools and anchors became available leading to refinement of instability repair procedures.2 The arthroscopy surgery in Indonesia was pioneered by Prof Chehab Rukni Hilmy in early 1990s. which was limited to some procedures in knee arthroscopy. The era of shoulder arthroscopy in Indonesia was started by the year 1998 by dr. L. Andribert P. Pontoh and developed rapidly until it become the gold standard for diagnostic and therapeutic treatment of most shoulder pathologies nowadays. The number of cases is increasing as well as the number of orthopedic surgeons interested in this field.

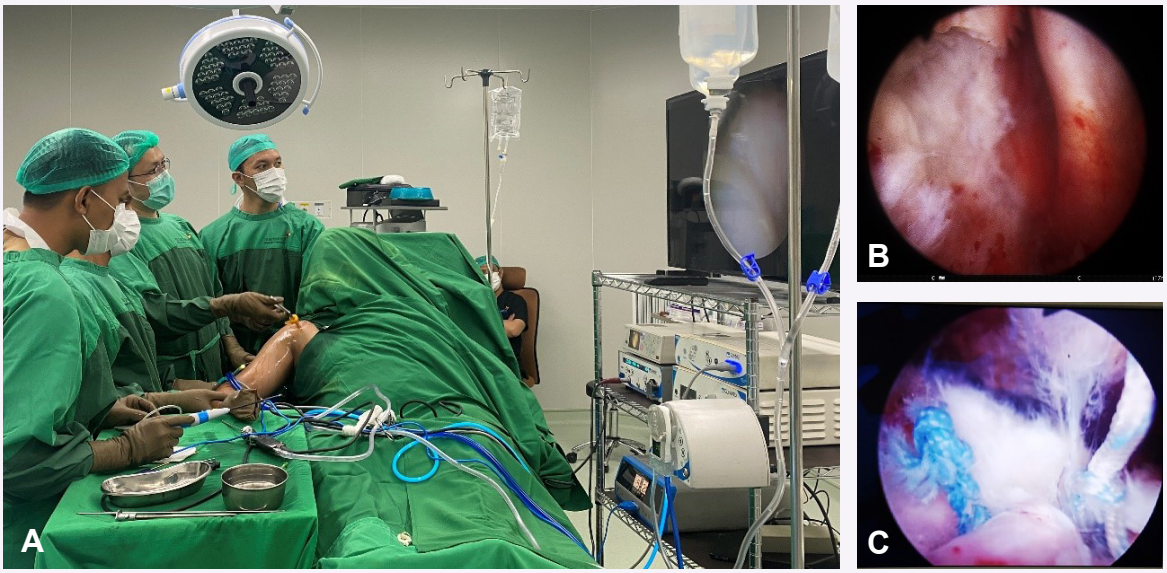


**Figure 2.** A. Shoulder arthroscopy procedure and operating theater settings. B. Intraoperative diagnostic view at the shoulder rotator interval. C. Arthroscopic repair of rotator cuff tear.

## Elbow arthroscopy

Elbow arthroscopy is the most technically challenging of all joint arthroscopies. It is not performed at a high volume in most training centers and carries substantial risks. However, indications and benefits compared to open elbow surgery are rapidly evolving. The science has begun since 1931; however, at that time, the size discrepancy between the scope and the joint space was too large. By 1971, a 1.7-mm arthroscope had been produced by Dr. Masaki Watanabe, which sparked renewed interest in elbow arthroscopy. Since 1985, the 4.0 mm 30° arthroscope has become the standard for accessing the anterior and posterior compartments of the elbow joint, with the less common use of the 2.7 mm arthroscope, and lately the 70° arthroscope is additionally used to assess deeper structures.[4]

There has been great interest in the application of elbow arthroscopy to treat not only intra-articular but also extra-articular pathologies. Reports of treating distal biceps tendon tears, olecranon bursitis, and triceps tendon tears with elbow arthroscopy have been published, and there is now curiosity about using elbow arthroscopy to perform medial ulnar collateral ligament reconstruction. Kamineni et al.5 introduced the treatment of a high-grade capsular contracture, with an extra-articular arthroscopic approach, which is currently considered an advanced technique for proficient arthroscopists. Interest in treating various intra-articular pathologies using elbow arthroscopy has also been increasing. Specifically, treatment of distal humerus, olecranon, and radial head fractures, tumor removal, and nerve-related pathology treatment are all being explored. [4]

In Indonesia, elbow arthroscopy was pioneered by dr. Iman Widya Aminata in 2014, starting with a simple procedure of arthroscopy-assisted diagnostics and synovial debridement. Nowadays, various therapeutic procedures have been done, such as for lateral epicondylitis, plica syndrome, loose bodies, elbow contracture, arthroscopically assisted bony fixation, osteocapsular arthroplasty for mild to moderate osteoarthritis, arthroscopic ulnar nerve decompression, and so on. This field of upper extremity MIS is relatively new but growing in Indonesia. We hope more and more surgeons and centers can provide elbow arthroscopy to manage elbow pathologies and thus reduce the risk of heterotopic ossificans, which is a common catastrophic complication of any open elbow procedure.


**Figure 3.** Elbow arthroscopy procedure and operating theater settings.

## Wrist arthroscopy

Terry Whipple, Gary Poehling, and James Roth developed a secure and standardized procedure for wrist arthroscopy in the 1980s, and since the 1990s, substantial advancements in wrist arthroscopy have been made as a result of the continuous development of different treatment alternatives. The emergence of wrist arthroscopy societies all over the world contributed to the global expansion and advancement of the procedure. The majority of techniques employed in big joint arthroscopy are either adapted from or transferred from already known methods due to the concurrent development of customized tools intended for tiny joints. The use of arthroscopy in the treatment of wrist diseases in both acute and elective cases has expanded as therapeutic arthroscopy has grown in popularity. Also, for the diagnosis and treatment of certain clinical problems, such as chronic ulnar wrist discomfort, wrist arthroscopy has emerged as a new standard. Similar to this, novel therapeutic approaches are challenging conventional surgical treatment approaches and long-term outcomes in a growing number of clinical disorders. As a result, wrist arthroscopy may eventually become as common as other arthroscopy procedures.[3,6]

Contrary to the initial milestones of small joint arthroscopy, of which debridement and resections are the only therapeutic options, over the past 15 years, a number of unique surgical techniques with particular surgical indications have been created. As techniques and instruments advance, it is now possible to carry out more complicated and accurate procedures with less difficulty. Nowadays, functional reconstruction treatments involving the repair of tissue defects and augmentation of important structures with graft material, as well as more particular anatomical structure fixing procedures, have been performed with established clinical benefit. [3,6]

Dr. Lukman Shebubakar is credited with introducing wrist and small joint arthroscopy to Indonesia in 2008 and 2019 (respectively). The baton of this development was passed on and continued by young hand surgeons until now. In our current practices in Indonesia, a wide range of wrist arthroscopic procedures have been done, namely, debridement, synovectomy, ganglionectomy, arthrolysis and release, ligamentous and triangular fibrocartilage complex (TFCC) repair and reconstruction, arthroscopic bone grafting for scaphoid non-union, and other arthroscopically assisted procedures such as distal radius fixation and radial styloidectomy.[6,7]

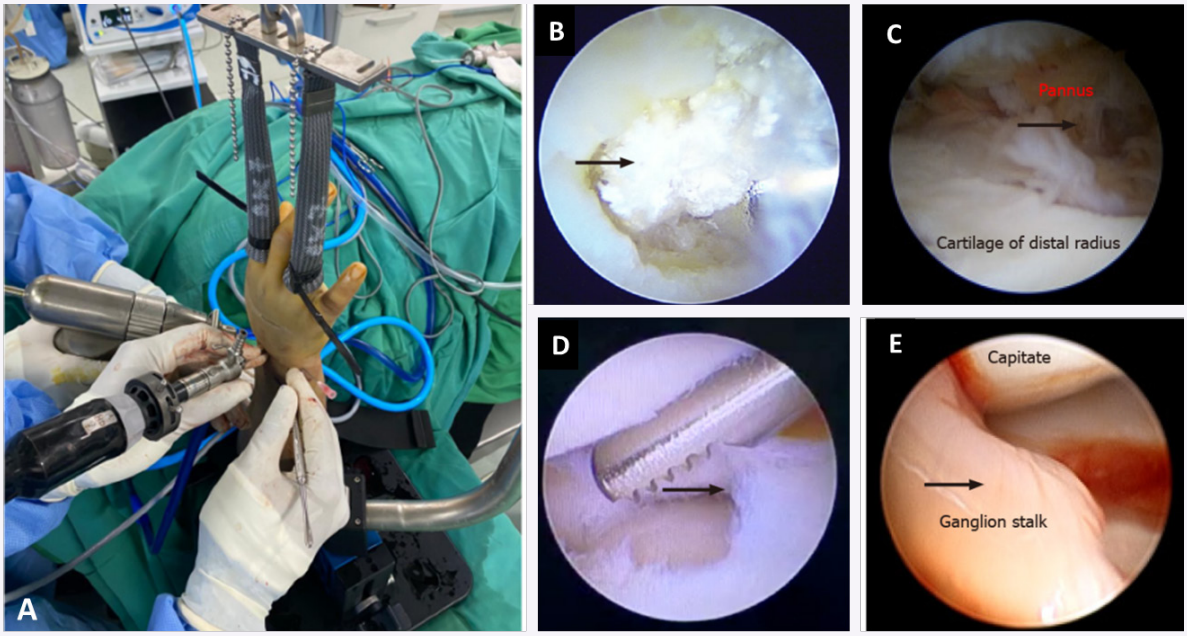


**Figure 4.** A. Wrist arthroscopy using a specialized traction system to accommodate joint space dilatation through the surgery. B-E shows various pathologies evaluated from the intraarticular wrist view. B. Crystals caused lunate destruction in the gouty arthritic wrist. C Pannus in rheumatoid arthritis was seen destroying the distal radius cartilage. D. A central TFCC tear. E. Ganglion stalk was seen protruding into the joint.[6]

## Minimal invasive plating and percutaneous screw fixation

Increasingly sophisticated surgical procedures, such as minimally invasive plate osteosynthesis (MIPO), have been developed for the fixation of distal radius fractures. The technique includes a combination of modalities, such as closed reduction, initial fixation with K-wire, and subsequent insertion of a volar anatomical stable angle short plate on the distal radius with fluoroscopy assisted reduction. Any accompanying intra-articular injuries, such as triangular fibrocartilage complex tears, ligamentous injuries, and intra-articular fracture fragments, can be evaluated and subsequently treated arthroscopically. This multimodal treatment gave better results than staged procedures, as demonstrated in a series of 42 distal radius fracture cases treated by the MIS technique by Satria et al.7 This approach offers a straightforward yet reliable method with reproducible and consistent results to achieve satisfactory clinical outcomes in all patients.

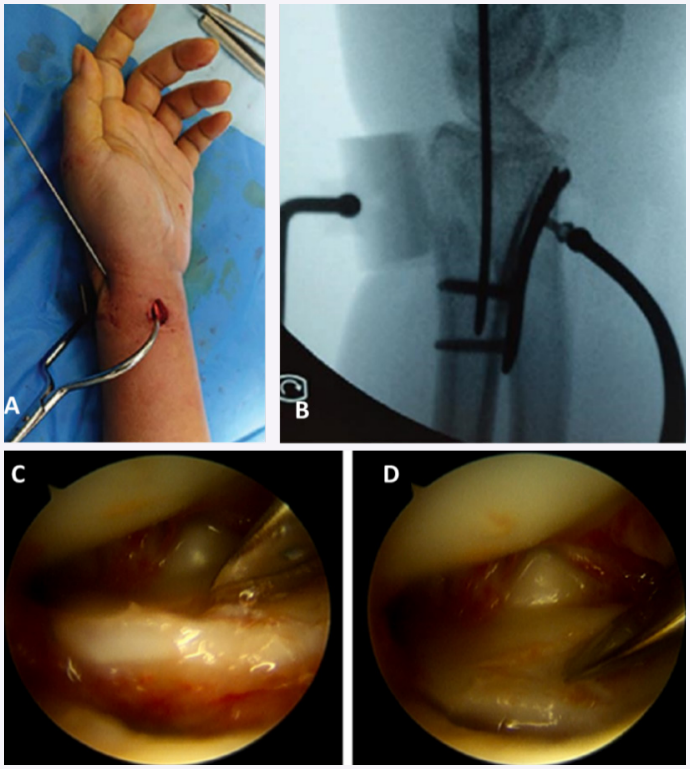


**Figure 5.** A-B. Minimally invasive plating using the extra-articular technique consisted of closed reduction and provisional K-wire fixation and application of soft tissue-bone reduction forceps to grip the plate over the bone. C-D. Arthroscopy-assisted intraarticular fracture reduction is used as indicated.[7]

Another MIS technique for bone fixation is the headless compression screw for carpal, metacarpal, and finger fractures. To date, there has been no consensus on the optimal treatment options for metacarpal fractures. Among the various fixation methods, intramedullary fixation with k-wire gives a satisfactory result but requires immobilization and future removal of the implant and may not always offer rotational control or secure fixation. A newer intramedullary technique using a headless compression screw has been developed to overcome pin-related complications. Several studies have shown that this technique offers a better clinical outcome in terms of earlier immobilization and fewer complications compared to pinning and other classic fixation methods.[8–11]

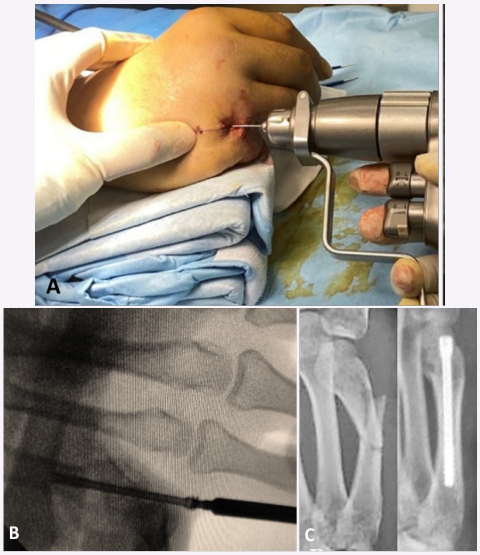


**Figure 6.** Closed reduction intramedullary fixation using headless compression screw for metacarpal fracture. A. Reduction with Jahss' Maneuver and provisional fixation with K-wire. B. A cannulated headless screw of appropriate size was inserted from the metacarpal head. C. Stable fixation was achieved as the thread of the screw is passing through the fracture line and the isthmus

In our country, this technique, Closed Reduction Intra Medullary Screw (CRIMS) fixation, was popularized by dr. Oryza Satria and has now become a current trend that is used not only for metacarpal fractures but also phalangeal fractures. It offers a less invasive procedure with minimal soft tissue dissection while providing good mechanical stability, which leads to a satisfactory outcome.

## Hand arthroscopy and endoscopic procedure

Currently, small joint arthroscopies are also developing for the proximal interphalangeal joint (PIPJ), metacarpophalangeal joint (MCPJ), and even thumb carpometacarpal joint (CMCJ). There is still a relatively limited indication for these procedures as a consequence of a very limited joint space. Of which, including synovectomy for inflammatory arthritis, tissue biopsy, removal of loose bodies and osteophytes, and assisting fracture fixation, fusion, and hemi-trapeziectomy. These procedures are also relatively new as the invention of small-sized arthroscope. [12]

**Figure 7.** MCP joint arthroscopy

## Minimally invasive soft tissue procedure

The MIS approach is also applicable for other soft tissue procedures such as the release of fascia (Dupuytren contracture), pulley (trigger finger), or nerve. Reduced postoperative pain, a quicker recovery time, an earlier return to work, and fewer wound-related complications like scar tenderness are some of its benefits. The currently popular method of treating carpal tunnel syndrome is endoscopic carpal tunnel release. Alternatively, minimal incision can

also be achieved with or without the help of specialized carpal tunnel retractor and blade with only 1.5 – 2.0 cm incision.[13,14] The majority of hand surgeons in our nation still favor the minimal incision approach over the endoscopic one for carpal tunnel release.

**The challenge of minimal invasive hand surgery practice in Indonesia**

In our country, MIS has some potential drawbacks, such as more expensive health expenses, the unavailability of facilities to support MIS, and a limited number of surgeons with MIS skills. Indonesia is the largest archipelago country in the world and the world's fourth-most populous country, with around 280 million people. Our healthcare system faces the challenge of optimizing health expenditures to accommodate the healthcare needs of all Indonesians equally with the best standard therapy. Unfortunately, our government health expenditure (GHE) is still below the average of low- and middle-income countries. Indonesia's health expenditure stood at only 2.9 percent of its GDP in 2019, which is not projected to reach the World Health Organization's (WHO) recommended 5% until 2027.[15]

Indonesia's out-of-pocket (OOP) expenditure is also higher (34.76%) than the WHO's recommended maximum of 20%. The costs of pharmaceuticals and healthcare services are the main contributors to high OOP in Indonesia. The MIS might have a contribution to this because the MIS technology, such as the arthroscopy systems, specialized implants, and instruments to perform MIS, comes at a higher price than those of the conventional systems, implants, and instruments. The other cause of high OOP expenditure for healthcare services is the low Indonesia Case Base Group (INACBG) rates. However, increasing INACBG rates will also raise capitation rates and ultimately exacerbate the current deficit of the Social Health Insurance Administration Body. To ensure that INACBG rates are increased without raising OOP costs for patients, the government must raise its health expenditures. [15]

Indonesia still imports 97% of the medical devices, so the medical devices, particularly for MIS, have become outstandingly expensive. The medical device must be affordable enough to pass through the e-catalog system, which is adapted to public hospital funding. Moreover, disposable items that are used in MIS must be calculated, although the main system itself has been purchased in advance and can be used repeatedly. These lead to an increase in operational expenses, which will be charged to the patients (or, otherwise, the hospital) if those expenses exceed the national health insurance coverage. Hence, MIS procedures - although it's not impossible - are hardly performed in public hospitals, especially in primary or secondary public hospitals that have less funding. It gives limited access to MIS—not more than 300 public hospitals around Indonesia (5–6 hospitals per province). The rest private hospitals can facilitate MIS. However, it come at a higher price.[15]

Furthermore, the need for advanced preoperative (and intraoperative) imaging in MIS is essential to planning the surgery and informing patients regarding the pathology and the course of treatment. Another drawback of MIS is the lack of this advanced imaging in Indonesia, which is limited to big cities. For example, from the data on functioning diagnostic imaging technologies in 2013, Indonesia only had 69 magnetic resonance imaging (MRI) units (0.286 units per million population) and 254 CT scanners (1.053 units per million population). This ratio was lower than in most of the Southeast Asian countries. [15]

Lastly, we believe that MIS has a long future with upcoming new innovations. Collaboration between clinicians, stakeholders, and the health industry is needed to provide the best and most affordable health services that cover the needs of many. As clinicians, we are trying to push the frontiers of minimally invasive surgical treatment, particularly in the scope of upper extremity surgery, to the benefit of patients, such as less post-op wound pain, faster rehabilitation and recovery, less surrounding soft tissue adhesion, better preservation of surrounding vascularity, and better cosmesis.

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