MEMOIR

“I Stumbled over the Ponseti Method almost by Accident”: In Conversation with Dr Shafique Pirani on His Adventures into Global Sustainable Clubfoot Care

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INTRODUCTORY WORDS FROM DR ALARIC AROOJIS

It is a great honour for me to write an introductory foreword to Dr Shafique Pirani’s interview by Jolie Leung. Dr Pirani is a global icon in the field of clubfoot and is recognized internationally for his humanitarian work of spreading the Ponseti method across several low- and middle-income countries (LMICs) in Africa and Asia. He is also well-known for his eponymous system for assessing the severity of the clubfoot deformity and his path-breaking MRI studies which beautifully demonstrated gradual correction of tarsal deformations and tarsal joint maldalignments during serial Ponseti casting. For his global humanitarian work, Dr Pirani has been bestowed with several prestigious awards including the American Academy of Orthopaedic Surgeon’s Humanitarian Award, the Pediatric Orthopaedic Society of North America Humanitarian Award, the Canadian Orthopaedic Association’s Award for Excellence, the Pediatric Orthopaedic Society of North America’s Angie Kuo Award, the University of British Columbia’s Impact in the Community Award, and Fraser Health’s Above and Beyond Award. Despite these and many other accolades, Dr Pirani is an extremely humble and modest individual and is a constant seeker of new ideas and novel research. He is a true clinician-scientist and an incomparable teacher, who has made it his life’s mission to proselytize the conservative treatment of clubfoot throughout the world. Very few are aware of the fact that it was Dr Pirani who popularized the Ponseti method not only in Uganda and sub-Saharan Africa but also in India. A chance meeting with him in 2002, converted many of us (then young) Paediatric Orthopaedists in India from skeptics to staunch acolytes of the Ponseti method. The first-ever Ponseti training workshop in India was conducted by him in Mumbai in 2003 and since then it has become the standard of care all over the country. Dr Pirani shares a close bond with India (he is originally a Gujarati Indian) and has returned to India several times since to share his knowledge and expertise. I am confident the reader will enjoy taking a trip down the memory lane with Dr Pirani and partaking of his reminiscences in this beautiful narrative.

ABSTRACT

In autumn 2019, Dr Alaric Aroojis asked me to interview Dr Shafique Pirani, a well-known teacher and advocate for the Ponseti method, to document his many clubfoot adventures. Dr Aroojis first met and was shown the method by Dr Pirani in 2002, and has since followed his contributions from showing correction of pathology in vivo by MRI to developing the Pirani Score to guide treatment, then teaching the method on every continent and developing public health programs for sustainable clubfoot care, and his current explorations in using technology to improve quality of care. I had the privilege of meeting him several times at his home in the fall of 2019. This is his story extracted from hours of footage. I am honored to tell it.

Keywords: Children, Clubfoot, Pirani scoring, Ponseti method.

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CAN YOU TELL ME ABOUT YOUR BACKGROUND?

All my family were born and raised in Uganda. I am of Indian heritage. My grandparents emigrated from Gujarat, India to East Africa over 100 years ago. In 1972, when I was 15, we were among the 80,000 Asians expelled from Uganda by its notorious President Idi Amin. As a polio survivor, I was interested in children’s orthopedic problems. After medical school at the University of London, orthopedic residency at the University of British Columbia (UBC), and fellowship in pediatric orthopedics at the Hospital for Sick Children in Toronto, I settled in Vancouver joining Dr Kerry Outerbridge in pediatric orthopedics at the Royal Columbian Hospital (RCH) in New Westminster. I am now a Clinical Professor at UBC.

I am incredibly lucky to be married to my wonderful wife Sally. Together we have been blessed with two remarkable and talented daughters, Aliya and Yassie. I am ever grateful for all their support over the decades.

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WHY HAVE YOU MAINTAINED SUCH AN INTEREST IN CLUBFOOT?

Curiosity, and my stumbling over the Ponseti Method—almost by accident. I should explain. Clubfoot is a common, age-old
Congenital deformity well recognized in history and mythology, art, and literature. Hippocrates, 4000 years ago, advised treatment used for centuries in the form of gentle corrective manipulations, strong bandages to hold corrections achieved, and special shoes to prevent relapse. During my fellowship, clubfoot was considered a surgical disease. Almost all needed one procedure or another for correction. I am ever grateful to Dr Peter Armstrong for teaching me the surgery of clubfoot, and for generating my lifelong interest. Intricate operations beautifully corrected complicated 3-dimensional deformities into a proper shape, leaving surgeons satisfied with their surgical prowess at the end of the operation. What could be better? I was hooked. At RCH, I started a clinic treating clubfeet. Curious about the history of its treatment, I organized a literature review, little suspecting the conundrum it was to present.

Can You Tell Me about the “Conundrum” and Your “Stumble”? A little overview of clubfoot treatment history is in order. After Hippocrates, not much changed till 19th century morbidity and infantile clubfoot dissections improved clubfoot pathoanatomy understandings. Scarpa in 1803 described various tarsal bone misalignments. Adams in 1866 added, very importantly, the presence of tarsal bone deformations describing in intricate detail, the shape differences while comparing infantile normal feet and clubfeet. With anesthesia and antisepsis, surgeons developed numerous procedures to realign misaligned tarsals. Realignments alone, however, could not correct tarsal deformations. Surgery did not have an answer for these. Even when successfully realigned, deformations left joints incongruent. Surgically corrected feet were scarred and stiff. Complication rates were high. There were of course proponents of non-surgical treatment. Kite in 1930 described sequential deformity correction by serial gentle manipulations and cast applications in meticulous detail. The calcaneocuboid joint was the fulcrum for correction. Surgery was unnecessary. Corrections took six months or even more. This was when, in my readings, I stumbled over the Ponseti Method. Dr Ignacio Ponseti in 1963 reported a new method of manipulation and casting. I was amazed. All deformities corrected in average 7.6 weekly casts, a dramatic improvement on Kite. Dr Ponseti dissected postmortem infant clubfeet. His pictures elegantly demonstrate the tarsal misalignments and deformations described by Scarpa and Adams. He also confirmed Farabeuf’s 1893 descriptions of subtalar motion and made the talar head the fulcrum of correction during manipulation, correcting deformities simultaneously rather than sequentially. Dr Ponseti reasoned that low load forces applied by well-molded casts would harness the ability of young connective tissues to respond biologically to correct both the tarsal bone misalignments and deformations. To my astonishment, deformities melted away! I was impressed. Parents were delighted surgery was unnecessary. I decided henceforth, all clubfeet should have Ponseti treatment, but with a sense of caution. Though feet looked normal at treatment end, I worried. Was I actually correcting the tarsal deformations and misalignments, or creating new deformities? How could I tell? We needed to visualize the mostly cartilaginous tarsals of early infancy to tell. X-rays were not useful—ossific nuclei when present were globular in shape. Could MRI help? Good fortune arrived. Royal Columbian Hospital acquired its first MRI machine. Dr David Hodges, a superb MRI radiologist, and I collaborated to develop an MRI scanning methodology that, in vivo, could show the tarsal misalignments and deformations demonstrated in Dr Ponseti’s postmortem dissection pictures. We scanned 19 clubfeet in 12 patients at the first, third, and fifth weeks of Ponseti treatment. In all feet, abnormalities of pathoanatomy observed on the initial scans either improved markedly or corrected completely by the last scan. This supported Dr Ponseti’s reasoning that low load forces applied by well-molded casts would harness the ability of young connective tissues to respond biologically to correct both the tarsal bone misalignments and deformations (Fig. 1). A further MRI study with Dr Sorin Siegler scanning clubfeet before and after each manipulation and casting clearly showed the steps in correction. Manipulation and casting immediately improved tarsal deformations and misalignments. No changes occurred during the times casts were on. Cast removals did not immediately cause relapse, permitting further correction with the next manipulation and cast (Supplementary Materials 1).

Tell Me about the Pirani Score Treatment was hampered by the absence of a widely accepted scheme to evaluate the amount of deformity. Available assessment schemes were problematic for daily use. Some confused classification with pathology evaluation. Others lacked interobserver reliability, validity, or were too cumbersome and impractical with up to 100 items. Indeed, the First International Congress had declared in 1990 “It is now recognized that one of our major endeavors for the evaluation of the unoperated CTEV”. I wondered if I could contribute, perhaps by identifying some useful signs sensitive to the amount of deformity. Scarpas’s observation “In very young children, when we endeavor, with our hands, to turn gently the point of the foot from within outwards, the prominence of the upper part of the foot disappears entirely or in great measure...because the naviculare is brought back to cover the head of the astragalus” inspired the first candidate sign—the talus head sign (Fig. 2). Candidate signs were tested for interobserver reliability and validity in our MRI studies. Six were found to have both, three in the hindfoot, and three in the midfoot. These six signs formed the Pirani Score for evaluating the amount of deformity in the unoperated clubfoot, a scheme now used worldwide.
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Dr Ponseti and his wife Helena came to Vancouver to give a lecture on clubfoot at the 2000 POSNA meeting. We were collaborating on the Uganda Clubfoot Project (UCP) Ponseti training manual I was developing. They graciously came home for brunch. During the meal as we discussed my MRI study findings, Dr Ponseti excitedly asked to see the slides. Seeing in them proof of his theory that both tarsal deformations and misalignments were corrected, he excitedly exclaimed “There! There! That’s what I have been telling everybody for forty years!” This was indeed a moment for me to savour! During the POSNA lecture 2 days later, he told 300 surgeons “Clubfoot is not a surgical problem” and then asked me to use some of his allotted time to present my MRI findings and help convince the audience of the power of his method. Annually thereafter, Dr Ponseti invited me to Iowa to lecture in his Ponseti conferences and to be an advisor to the Ponseti International Association Board. Our relationship, which began as colleagues, over time blossomed (Fig. 3). I truly consider Dr Ponseti as a mentor, clear in his thinking, very supportive, gentle, and generous with his advice to a much younger man. I remember with fondness how Dr Ponseti respected how my path of thought led from intrigue about his method to learning it, testing it, teaching it, and then taking it

Figs 1A to D: Two-month-old infant with right clubfoot during Ponseti treatment. Sequential MRI oblique axial images perpendicular to the talonavicular joint show progressive correction of the medial talar neck inclination, the medial talonavicular displacement, and the wedge-shaped navicular from (A) the first cast to (B) the third cast to (C) the fifth cast applied after percutaneous tenotomy. With the application of the fifth cast, the medial talar inclination is reduced to normal, and the talonavicular joint is reduced anatomically and congruent. (D) Tracings of the correction of the medial talar neck inclination and the medial talonavicular displacement seen in (A), (B), and (C)

Figs 2A to D: Talar head sign (A) Palpate the talar head laterally with a thumb. Gently abduct the foot until resistance is felt. Assess how well the navicular reduces by determining how much talar head remains palpable. (B) Score 0 if navicular slides between thumb and head of talus and talar head is not palpable. (C) Score 0.5 if navicular reduces partially and both talar head and navicular are palpable. (D) Score 1 if navicular does not reduce and only talar head is palpable

Can You Tell Me About Meeting Dr Ponseti?

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How could it be done? Curiosity struck again! My forefathers had a longstanding altruistic tradition. I accepted the challenge to at least try. Personal service delivery would not make an impact. A different strategy—teaching many providers—might work. I returned in 1999 to meet local stakeholders, understand the healthcare system’s context and constraints, demonstrate the method, and explain how its use could reduce the need for surgeries. I then asked to teach suitable local healthcare providers. We were encouraged to try, but to focus trainings on their cadre of orthopedic paramedics (Orthopedic Officers). There were simply too few doctors. We and other well-wishers, with Rotary Club of Burnaby funding, proposed the Uganda Clubfoot Project (UCP) experiment to see if Ponseti clubfoot treatment could be brought to Uganda successfully (Supplementary Materials 2). Posters in clinics and hospitals raised awareness that clubfoot can be treated and where to go for treatment (Supplementary Materials 3). One hundred and fourteen healthcare providers were trained in the Ponseti Method using the training manual (Supplementary Materials 4) approved by Dr Ponseti and models provided by John Mitchell (Fig. 5). Locally available materials were used for foot abduction braces (Supplementary Materials 5). Trained orthopedic officers started using the method in 1999. Dr Macharia, in his Master’s thesis, reported short-term results of Ponseti clubfoot treatment by orthopedic officers at Mulago Hospital (Supplementary Materials 6). Seventy-two percent of clubfeet corrected in an average of 6.2 casts. UCP provided proof of principle that the method could correct deformity in Uganda. Parents, once aware, brought their children for treatment. Orthopedic paramedics, once trained, could correct the deformity (Video 1). Yes, there were problems. Almost 25% of registered children were lost to follow-up, likely from transport difficulties and traditional beliefs. To make Ponseti clubfoot treatment widely available, Uganda’s public healthcare system needed to be strengthened, an endeavor that required public health expertise and advocacy within the Ministry of Health (MoH) to promote uptake and sustainability.

How Did You Do That? Were You Successful?

We found necessary partners to join the endeavor—Dr Richard Mathias at UBC’s School of Public Health, Dr Joseph Konde...
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Lule from the Makerere School of Public Health in Uganda, Dr Jacinto Amandua, Commissioner for Curative Services at the MoH, MR Edward Naddumba, Head of Orthopaedics at Makerere University, and Dr Norgrove Penny, CORU. Our team won Canadian International Development Agency (CIDA) funding ($980,000 CAD) for the Uganda Sustainable Clubfoot Care Project (USCCP) to strengthen the public healthcare system such that there would be high awareness of clubfoot in healthcare workers and the public, and affected infants would be taken for available and effective Ponseti treatment (Supplementary Materials 7).33

Key MoH documents guided project strategies. The Uganda Poverty Eradication Plan (2002) cited “ill health as the leading cause and consequence of poverty”.34 Congenital deformities, mostly clubfoot, were responsible for nearly a third of all musculoskeletal deformity and ill health in Uganda (Supplementary Materials 8). A 1997 set of standards guided districts on strengthening services to meet the needs of the disabled population.35 Strategies included assessment, raising awareness, incorporating rehabilitation into health workers’ curricula, capacity building of medical personnel to new approaches, and decentralization of service provision.

We determined the incidence at 1.2 per 1,000 live births36 and surveyed healthcare providers’ and major tribal groups’ knowledge, beliefs, and feelings about clubfoot (Supplementary Materials 9). We needed a window into the population’s mindset about clubfoot to develop strategies for parents to overcome barriers to access treatment.37 Ministry of Health and USCCP launched an awareness paper and radio campaign and added a check box for “birth defect” to the Child Health Card, a “health passport” for all children (Supplementary Materials 10 and 11).

Clubfoot curricula for health professionals in service, and students at the School for Orthopedic Officers, the Orthopedic Technology Training School, 4 medical schools and 33 nursing and midwifery schools, were updated with Ponseti clubfoot teaching modules (Supplementary Materials 12) and materials.38 Uganda Sustainable Clubfoot Care Project provided in-service training to 1,076 healthcare professionals. Forty clubfoot clinics were opened across Uganda’s four regions. By July 2013, 3,277 children had been treated. The World Health Organization recognized USCCP’s success stating, “The project shows that clubfoot detection and treatment can quickly be incorporated into settings with few resources” in its inaugural World Report on Disability (Supplementary Materials 13).39

DID YOU ACHIEVE SUSTAINABILITY?

Logistical and resource issues remain of course, but I think we have made a huge difference in a decade from “what can be done for walking age children with untreated clubfoot” to now where Ponseti clubfoot treatment is standard teaching and treatment is widely available (Supplementary Materials 14).23 I want to strongly emphasize key ingredients necessary for success in such endeavors: committed local leadership, single-minded focus, and hard work by all stakeholders. I learned this lesson in another Ponseti public health clubfoot initiative where local leadership constraints compromised outcomes.

CAN YOU EXPLAIN?

We were invited to bring a USCCP type initiative to Bangladesh to help with the problem of untreated walking-age children with clubfeet. Dr Mathias and I started planning. We developed a team. Walk for Life (WFL), a Bangladesh-wide physiotherapist-centered clubfoot treating NGO, agreed to be the local implementing partner and conduct proposed evaluations. The National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) and the Bangladesh Orthopaedic Society (BOS) agreed to coordinate capacity-building activities. The team proposed a project, Sustainable Clubfoot Care in Bangladesh (SCCB) (Supplementary Materials 15), and was successful in securing ample funding ($4,320,160 CAD) from another Department of Foreign Affairs, Trade, and Development Canada (formerly CIDA) competitive grant. SCCB aims were as in USCCP—to integrate Ponseti clubfoot treatment and teaching into the public health system and public schools of healthcare. However, we also wished to engage with the Ministry of Health and Family Welfare (MoHFW) to create policy surrounding clubfeet that would clearly clarify their strategies and procedures for sustainability.

While planning SCCB details, WFL, our local implementing partner, withdrew from the project stating “The reason is, quite simply, we cannot comply with CIDA requirements—either now or in the implementation”. I was astounded. Can you imagine? Ample funding, a good project, but no local implementing partner. So, we searched again and found BRAC, a huge NGO with an excellent reputation working in 70,000 villages and 2,000 slums. They agreed to be the local implementing partner. icddr,b, an internationally recognized health research institute based in Dhaka, agreed to conduct proposed evaluations. We started and made reasonable progress in our capacity-building activities. We developed Ponseti clubfoot treatment modules and materials for MBBS and Postgraduate curricula (Supplementary Materials 16 to 19), and created a network of 17 Ponseti Training Centers at public medical college hospitals where children could be treated and students would learn about clubfoot. Sixty seven orthopedic faculty were trained as Ponseti trainers (Fig. 6). We then trained a wide net of community health workers to identify foot deformities at or shortly after birth and refer to a clubfoot clinic. However, BRAC struggled to provide satisfactory human resources, accountability, project management, and treatment materials which compromised...
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potential outcomes. Unable to manage and deliver the project as per the Project Implementation Plan logic model, BRAC prematurely withdrew. Without a local reliable and capable implementing partner, icddr,b were unable to complete studies underway, and NITOR and BOS were unable to create a larger network of Ponseti Training Centers.

You Mentioned Clubfoot Policy. How did That Come about?

Here, we were entirely successful. Sustainable Clubfoot Care in Bangladesh was able to develop a policy document for the MoHFW—The National Strategy and Guidelines for Clubfoot Care in Bangladesh (Supplementary Material 20). We conducted a baseline situational analysis and engaged a variety of key stakeholders to identify gaps in governance, service delivery, health workforce, awareness, sensitization, engagement, and quality assurance. The guidelines recommended the creation of a National Clubfoot Program to take over from SCCB and address these gaps through five pillars. Its Costed Action Plan was approved in April 2017 in the 4th Health, Population and Nutrition Sector Programme (2017-2022) providing MoHFW funds to implement the Guidelines, thereby securing sustainability and further strengthening of outcomes achieved by SCCB into the future (Fig. 7). Bangladesh became the first nation to have a policy on clubfoot, and funds to implement. This “first” reflects the importance of working with nations’ public health systems for sustainability (Fig. 8).

Are You Working on Any Projects Now?

Yes—I am now curious whether technology can help frontline providers choose the right treatment every time at each of about twenty visits over the four-year treatment span. Why? Because clinical reasoning errors are common and lead to treatment decision errors causing adverse outcomes. Ponseti clubfoot care is no exception. So what can be done to reduce these clinical reasoning errors? Recognized strategies include clinical decision support systems that prompt frontline clinicians in real-time to gather all relevant visit clinical data and base treatment recommendations on evidence-based guidelines. At the 2017 Delhi Global Clubfoot Conference, Pankaj Jain, a software technologist working with Dr Mathew Varghese, presented his work on a Ponseti Method clinical decision support app that used the Pirani Score to reduce errors. We decided to collaborate. We would encode rules-based Ponseti protocols for diagnosis and treatment into the app and refine its user interface for intuitiveness.

It is called the Ponseti Clubfoot Navigator (PCN), a web-based app for mobile and tablet formats. An intuitive user interface prompts the user to elicit and record, in real-time, all the necessary clinical history, examination, and investigation findings for that specific visit. PCN’s encoded Ponseti treatment program will use these findings to generate a “reasoned” treatment recommendation for the clinician—again, in real-time (Fig. 9). Should the clinician accept the recommendation, the app will then guide the clinician in performing the recommended treatment and record the immediate outcome. Should the clinician choose an alternate treatment, the app will guide the clinician in the alternate treatment and record its immediate outcome. Potentially, the database will provide clinicians with aggregate statistics and produce a dashboard of user-selected performance indicators. After sufficient data acquisition, deep analytics may be possible. PCN is now being field-tested. Ponseti experts find the user interface engaging. In almost all cases, it makes the correct treatment recommendations. It is a complicated work in progress. However, if successful, affordable, and used widely, the potential for unprecedented broad application is clear.

Final Thoughts

At the end of our recording sessions, I had the opportunity to visit Dr Pirani in his clinic. He spent a few moments contemplating how his curiosity about clubfeet several decades ago presented a conundrum. When solved, it opened doors to new ways of evaluating the deformity, the reawakening of a decades-old affordable, non-surgical treatment for clubfeet with better outcomes, and its spread to populations that needed it the most. As Philo of Alexandria described, “Learning is by nature curiosity … prying into everything, reluctant to leave anything, material or immaterial, unexplained”, and Dr Pirani’s unending curiosity has led him on an adventure into global public health with the Ponseti Method, touching the lives of children around the world.
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**Video 1: The Uganda Clubfoot Project**

**Supplementary Material**
All the supplementary material from Supplementary 1 to 20 are available online on the website of www.jfasap.com.

**Supplementary Material 1–20 Details**
The below mentioned supplementary material are available on Journal Website:

1. Mahmoudian, R. Mechanics and Development of Tarsal Cartilage Anlagen with Application to the Study of Clubfoot. Doctor of Philosophy, Drexel University, 2010.
2. A Proposal for the Treatment of the Clubfoot Deformity in Uganda: The Uganda Clubfoot Project. Uganda Clubfoot Project awareness raising posters.
3. Manual for Orthopaedic Officers and Physiotherapists.
4. Production Manual for the Steenbeek Foot Abduction Brace.
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