

Map by Christopher Brest, Ph.D.

Renal colic on an African cliff while searching for smallpox

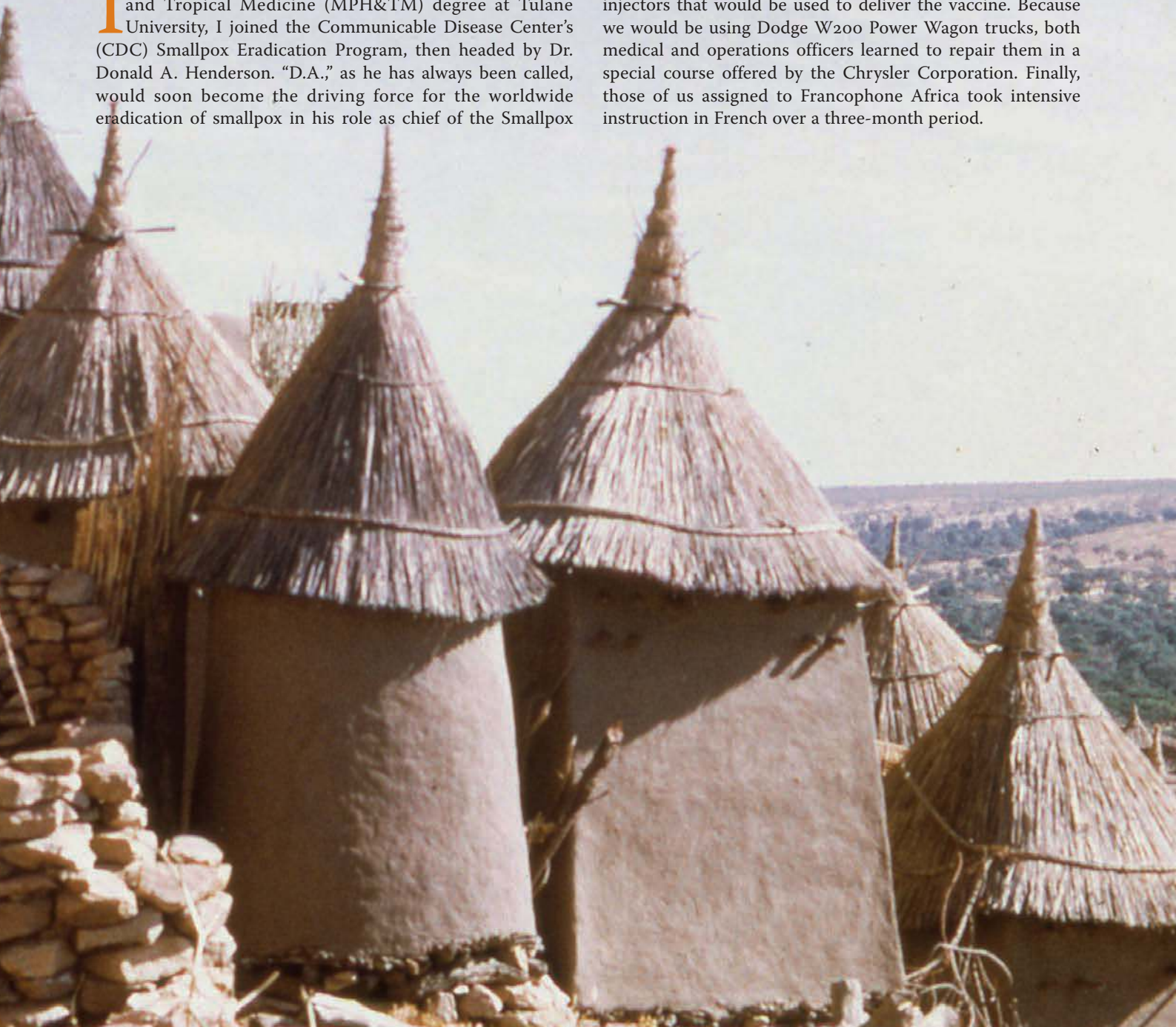
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In July 1966, after completing my Master of Public Health and Tropical Medicine (MPH&TM) degree at Tulane University, I joined the Communicable Disease Center's (CDC) Smallpox Eradication Program, then headed by Dr. Donald A. Henderson. "D.A.," as he has always been called, would soon become the driving force for the worldwide eradication of smallpox in his role as chief of the Smallpox

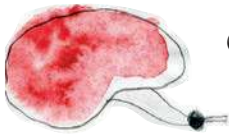
Eradication Unit at the World Health Organization from 1966 to 1977.¹

CDC recruited both medical and operations officers that summer to staff a 20-country smallpox eradication and measles control effort in West and Central Africa.² As a medical officer, I began my training with the Epidemic Intelligence Service course, and an extensive smallpox eradication instructional program. In the latter, we not only mastered the epidemiology, management, control, and prevention of smallpox, but also learned how to operate and repair the Ped-O-Jet injectors that would be used to deliver the vaccine. Because we would be using Dodge W200 Power Wagon trucks, both medical and operations officers learned to repair them in a special course offered by the Chrysler Corporation. Finally, those of us assigned to Francophone Africa took intensive instruction in French over a three-month period.



Renal colic on an African cliff while searching for smallpox

A few weeks into this training, D.A. and his staff announced our country assignments. As he read off the list of countries and those assigned to them, he did not mention my name. The unpleasant thought occurred to me that I would be assigned to CDC headquarters in Atlanta, and never get to use all my training in the field. However, at the end of the session, D.A. said that he wished to see me in his office. There I found Dr. William H. Foege, Dr. Stanley O. Foster, Dr. Ralph Henderson, and, of course, D.A., waiting for me.



Off to Mali, not Bali . . .

After a rather lengthy preamble in which he emphasized the importance of achieving the goal of smallpox eradication in a relatively short period of time, D.A. said that there was an especially challenging country in West Africa called Mali. It had an anti-American Marxist government, difficult terrain, large nomadic populations, a poor transportation infrastructure, weak health services, and a large number of smallpox cases. Because I had completed my residency in internal medicine, possessed an MPH&TM degree, had already worked in Africa,



and spoke French well, D.A. said he considered me the best qualified medical officer to go to Mali. I later learned that the only American physician in the country had been expelled earlier that year, that a WHO team had concluded in 1965 that the prospects of eradicating smallpox were “bleak,” and that it would take at least a decade to achieve this goal.³

Despite many misgivings and trepidations, I arrived in Mali in late 1966. French physicians already there told me and Jay Friedman, the operations officer, that we would never succeed in eradicating smallpox in Mali because everyone who had tried to do this before us had failed. D.A., now in Geneva, told us not to lose heart; he was confident we could do it.

We trained 40 vaccinators in the use and repair of the Ped-O-Jet automatic jet injectors, and Jay Friedman spent long weeks teaching the maintenance and repair of the Dodge trucks to a dozen drivers. Since each truck carried a kerosene-operated refrigerator, we also trained a special category of support staff, called “frigorist” in Malian French, to oversee these units. We arranged for storage of the vaccines in the refrigerated rooms of the local abattoir, and asked Père Michel, a missionary and director of a vocational school, to design and make cold boxes for transporting the vaccines. Père Michel’s boxes assured our “cold chain” because they kept the vaccines at an acceptable temperature for five days.

Despite the Marxist rhetoric on Radio Mali, and constantly being addressed as comrade, we created a well-trained cadre of vaccination teams within a few months. However, the Malians refused to allow us to leave the capital city of Bamako to investigate reported cases and outbreaks of smallpox. At the time, there were 2,000 Soviet and 6,000 Chinese advisors in Mali working on a broad range of development projects. The Malian government kept the 40 Americans attached to the U.S. Embassy bottled up in Bamako, and only rarely allowed them to leave. We believed that they were concerned that the Americans would see the failings of Communist Bloc projects, would witness popular discontent with socialist government policies, and would find that life in rural areas was not as Radio Mali described.

Eventually, the American ambassador, C. Robert Moore, informed the Ministry of Foreign Affairs that the \$1.2 million project in Mali would be terminated if we were not given permission to travel. The Malians quickly relented. However, convincing Malian health officials to concentrate the vaccination teams in areas where smallpox was being transmitted, instead of according to local political considerations, proved more difficult. The arrival of a new director general of Public Health, Dr. Daouda Keita, and a new director of the Endemic Disease Service, Dr. Ousmane Sow, in the spring of 1967, quickly changed this hardened Malian position. Both men held graduate degrees in public health from the University of Montreal, and understood the need to use the next dry season (October

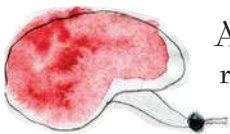
A woman and her child with late stage smallpox, Kouna, Mali.

through June) to vaccinate the peoples of the great Inland Delta of the Niger. This region, with its nomadic populations and migratory fisherman, then accounted for most of the smallpox cases, which in 1967 totaled 293.⁴

By October 1967, we had put together a detailed logistical plan, using eight vaccination teams to cover 150,000 square miles of cliffs, sand dunes, plains, and swamps. Once implemented, we vaccinated a third of Mali's population: 1,500,000 against smallpox, 300,000 children against measles, and 600,000 people against yellow fever. The vaccinators visited 3,000 villages and 1,000 nomad camps, all within a nine-month period. Significantly, we had thoroughly, or so we thought, vaccinated all the villages along the rugged terrain adjacent to the Mali-Upper Volta border. Because nomads freely move across this border, setting up a barrier of immune populations was crucial to keeping smallpox from being carried into the country.⁵

Unfortunately, a few months after vaccinating this region, we received reports of smallpox in the village of Kouna, which sits in a high valley at the end of the Bandiagara Escarpment. At the same time, my counterpart in Upper Volta, Dr. Christopher D'Amanda, learned of smallpox cases in the adjacent area on their side of the border. The persistence of smallpox in a vaccinated area was of significant epidemiologic concern, and thus I decided that I had to quickly investigate this epidemic and bring it under control.⁶

After much logistical planning, Mark LaPointe, who was then the operations officer in Mali, and I, with our Malian counterparts, went to the town of Tominian near the border. There, we met Thomas Leonard, the operations officer for Upper Volta, and Dr. David Vastine, who was visiting from CDC. We quickly learned that Kouna was not accessible from the Mali side of the border, which meant that our vaccinators had never reached it. So we crossed the border, and over the next two days trekked up into Kouna to investigate the epidemic.



Anti-lion strategy:
running fast?

Kouna lies at the southwestern end of the great Bandiagara Escarpment, which runs for 150 miles in central Mali, and reaches a height of 1,200 feet. The spectacular cliffs that characterize much of this escarpment are reduced to steep hills in the area of Kouna, but it was nonetheless a difficult trek through wilderness where lions frequently attacked domestic stock. As protection against the lions, the district commissioner gave me a locally forged sword, which he said would be sufficient to fend them off. I had my doubts about this, and placed my trust in my ability to run and the numerous tall trees.

On arriving in Kouna, we discovered that it was not one

composite village, but eight unique units separated from each other by about half a kilometer. Distance was not all that separated the people of this high valley settlement. Those living on the higher ridges were Dogon people, while those on the valley floor were Marka. These two ethnic groups spoke mutually unintelligible languages, had separate authority systems, and were frequently in dispute.

Despite these obstacles, we found 65 cases of active smallpox, and discovered that most of the population had never been vaccinated in the past, as evidenced by the absence of vaccination scars. We vaccinated everyone in Kouna, and in so doing brought the outbreak under control.

Because of our experience at Kouna, I took seriously any reports of smallpox in areas supposedly previously vaccinated. Physical inaccessibility, coupled with a single case of smallpox introduced from the outside, could easily start an outbreak in a nonimmune population. During 1969, we documented only one case of smallpox in Mali compared with 131 in 1968, and 293 in 1967.⁴ By the end of 1969, we had vaccinated close to 3.5 million of Mali's then 4.5 million people.⁷ Yet, the underreporting of cases of smallpox and the risk to eradication presented by unvaccinated, difficult-to-reach populations were my constant concern.

One geographic area of particular worry was the Bandiagara Escarpment, which runs parallel to the border with Burkina Faso (then Upper Volta). Here, Dogon villages perched high up on the cliffs or in the rocky valleys cutting through them were sometimes beyond practical physical reach. As a partial solution to this problem, we sometimes asked the population to descend from their fortress-villages to the base of the cliffs below. We also vaccinated people at local weekly markets, which are held every five days among the Dogon. Most adults attend these markets, which at least guaranteed that we had acceptable vaccination coverage among them.⁸

Cultural barriers among the Dogon also presented us with significant challenges. The Dogon, then as now, are a very tradition-bound society. They have strongly resisted conversion to Christianity and Islam, and order their lives around annual rituals organized by elders. Their complex cosmological and religious beliefs permeate their lives and greatly determined their response to our offer to vaccinate them. We were fortunate that, early in our efforts among the Dogon, a chance event occurred that greatly fostered their subsequent acceptance of vaccination.

The religious leader in one village advised families to hide their children in the granaries when the vaccinators arrived. As a result, none of the children were vaccinated against measles and smallpox. However, leaders in adjacent villages allowed their children to be vaccinated. Two months later, measles appeared among the children of the unvaccinated village, where it carried a mortality rate of 50 percent. No cases occurred in vaccinated villages. News of this event rapidly spread up and down the cliffs, after which Dogon cooperation greatly improved.⁹

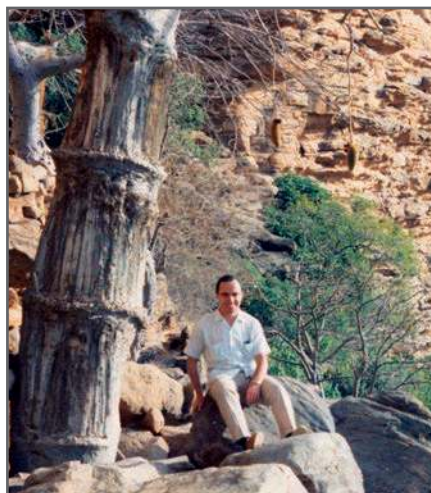
Nonetheless, some Dogon villages still refused vaccination in the belief that our automatic injectors were actually guns, and our intent genocide. These islands of unvaccinated people were afforded protection by the herd immunity of the majority, but during the waning days of mass smallpox vaccination in West Africa, they posed a potential threat if they came into contact with a smallpox case. Such a threat was far from theoretical because, isolated as the Dogon appeared to be, they were not cut off from the outside world where smallpox cases were still occurring. Young Dogon men regularly traveled to the labor markets of Ghana, the Ivory Coast, and Liberia during the dry season, and then returned at the beginning of the rains in June to help cultivate their family fields. Older Dogon men engaged in long-distance trade as far as Nigeria and the Congo. Given all of these factors, by early 1970, when it appeared that we had eliminated smallpox in Mali, I was especially alert to any reports of the disease along the Bandiagara Escarpment.

In December 1969, the cool season began in Mali. Temperatures fell from a usual high of 110° to 120°F in the shade to 90° to 100°F. Late in the month, the medical officer of the Bandiagara District sent a telegram to the health ministry stating that there might be several smallpox cases in a remote village along the escarpment. Given all of the difficulties we had had vaccinating this area and the presence there of significant populations of unvaccinated people, I undertook an immediate on-site investigation.

Despite the drop in temperature, the plateau above the cliffs was still a cauldron of heat. As I made my way over four hours of rutted track toward the sub-district headquarters at Sanga, the thermometer in my truck read 110 degrees. It was a dry heat in which loss of body fluids was imperceptible because perspiration immediately evaporated.

When I arrived at the village of Sanga, I learned that Ogobara Dolo, the paramount chief who had helped us in our vaccination efforts, was slightly ill. As a result, he was unable to guide me down the cliffs early the next morning. In his place, he sent his young son, Oumar, to accompany me, my driver/assistant, Kassim Sangaré, and Kassim's apprentice, Karim Sidibé.

At 5:30 a.m., while the air was still clear and fresh, we started off across the high breezy plateau, through shaded villages where indigo-robed Dogon women pounded millet and filled round earthen jars with cold water from deep wells. We descended the gradual incline onto the lower plateau, crossed a broad clear stream, and then edged our way toward the cliffs along a narrow precipice that overlooked a deep forested canyon. We soon left the main trail and climbed



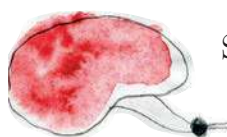
The author descending the cliffs above the village of Irieli.

up for half an hour through heavy brush until we reached a large grotto. We made our way through a maze of ancient mud brick ruins and pottery shards, remnants of the Tellem people who had lived here before the fourteenth century. After resting in the sinuous grotto, we pushed on again toward the edge of the main cliff. Kassim and Karim stood on a lower ledge below the grotto, and suggested that I jump down instead of walking over the circuitous trail. I jumped the five feet, never realizing that in so doing, I had initiated what would become a medical emergency.

We finally arrived at the edge of the 1,200-foot cliff. The view here is breathtaking as you emerge from the shadows

of a towering canyon, and far below see the village of Irieli with its grass-roofed houses and cylindrical mud brick granaries hugging the base of the cliff. Beyond the cliff, the land races away into the horizon, an undulating expanse of dunes and prairie covered with thorn trees, scrub, and giant baobab trees. From previous treks down the cliff face, I knew that the descent would be difficult and time-consuming.

We jumped from one boulder to another, slid down patinated wooden planks that bridged small crevices, and after two hours arrived at the base of the cliff. As we moved off the rocks and onto a sandy footpath, I felt a mild pain in the left side of my abdomen. We moved toward the center of the village through a labyrinth of rock walls and mud brick construction, followed by increasing crowds of small children.



Setup for stones: heat and dehydration

I knew that we would have to first meet with the village elders in the toguna, a palaver shelter comprised of numerous sculpted wooden or mud brick columns roofed over by stacks of millet stalks. The pain in my left upper quadrant soon took on an episodic pattern, with each wave being stronger than the previous one. On arriving at the toguna, the elders seated inside invited me to come in. I exchanged greetings with them, shook all their hands, and sat down on a patinated slab of rock. Except for a peculiar sense of urinary urgency, my symptoms suddenly abated. The clinical acumen of a clinician often disappears where his or her own illnesses are concerned. Sitting in the dark shade of the toguna, I thought I might have colonic spasm, which I had had in the past.

The elders told me that several young children had rashes that looked like smallpox. Yet, as I examined some of the chil-

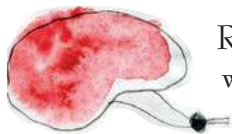
dren who had been following me, I saw that they had obvious smallpox vaccination scars.

I finally left the toguna and, accompanied by some of the elders, went to see all of the children who had rashes. The first was nearby, and on walking into the family compound, I instantly knew that it was chickenpox. I could have left then, especially as the pain had once again returned. However, I knew that I had to see all the affected children because chickenpox in one did not rule out smallpox in the others. Within an hour, I had examined all the children, who clearly had chickenpox. Declining an offer from the elders to share a meal with them, I started on the four-hour trek and climb that would take me up the cliff face and back to Sanga. As I walked along the sandy path toward the village of Banani from where we planned to make the ascent, the pain again intensified, and I felt nauseated. I wondered if I might have a volvulus or an intussusception. Kassim, sensing the change in my mood, asked me if I was all right. I told him I was fine.

As we neared the village of Pegué, I decided to make the ascent there instead of farther on at Banani because it is closer to Sanga. The waves of pain were now the most excruciating I had ever experienced in my life, but I kept telling the others not to worry. At no time when I was struggling back up the cliff did it occur to me that I had renal colic. I even thought I might have a perforated viscus, and visualized dying on the cliff.

My primary concern was to get to a place where I could be helped. Sanga was ten miles and four hours away, 1,200 feet up the cliff and across the plateau. Beyond it, Mopti was four more hours away over a rough track. At best, it would take eight hours for me to reach competent medical hands, and with that thought before me, I despaired and resolved that I would have to accept whatever happened.

What was to have been a leisurely ascent up the cliff now became a desperate effort to get to help. As I crawled up through Pegué, bent in two, with Karim helping me, a woman came down the path screaming at us to stop. She said that a sacrifice was being held over one of the ancestor shrines ahead, and that we had to go around the village. The sound of bull roarers echoed off the cliffs as the ceremony got under way, and we retreated to another path.



Renal colic . . .
what else could it be?

The sun had long since become an additional enemy as it unmercifully beat down on us, rapidly exhausting everyone. Finally, we arrived at a large tunnel where we rested. The rest was not palliative to my pain because I was unable to remain still. I lay writhing on the ground of the tunnel, holding my abdomen with my crossed arms. Kassim told me later that he

was sure I was going to die.

I knew that I had to eventually leave the tunnel, and after a while we made our way up through a maze of canyons. The fact that I was able to move and felt a powerful desire to keep moving should have given me more than a hint about the diagnosis, but renal colic never occurred to me, not least because I had never seen a patient with it in all my years of medical training.

After a while, we came to a grove of baobab trees where Kassim suggested we rest. Nearby, I noticed a man on a rocky plateau just below us. I asked Kassim to approach him to see if he knew of any donkeys nearby on which we could ride back to Sanga. Kassim returned and said in French, "This man does not speak either French or Bambara. He only speaks Dogon, and the language you speak with the Americans at the embassy." When the man arrived under the tree, he addressed me in English, and said that he had worked in Ghana a number of years before, where he had learned the language. When I asked him about donkeys, he said that there were none nearby but that there was a caravan of Tuareg nomads with camels a short distance ahead. He offered to fetch one of the camels for me, but, given the severity of my pain, I was fearful I would fall off during a very undulating ride. We finally arrived at Sanga around 3:00 p.m.

Francis and Laura McKinney were American missionaries who had worked in Sanga for many years. They quickly put me in a comfortable bed in their rest house. However, I could not keep still on the bed. I finally urinated, and seeing the gross hematuria I finally realized that I had renal colic. I had a bottle of Demerol with me, as well as needles and syringes, and could have self-administered 50 mg, but the voice of my professor of surgery, Clarence Dennis, seemed to echo off the cliffs: "Never give a narcotic to anyone who might have an acute abdomen." So I decided not to medicate myself until a surgeon in Mopti had examined me.

Ogobara Dolo came to the McKinneys and offered to call a traditional healer to treat me, while Mrs. McKinney said that her tea would calm the pain. Ignoring their pleas, I decided to race to Mopti, four hours away. The trip back, over rough tracks, was agonizing. I spent it in the back seat of the truck writhing with each new wave of colic. The sun was setting when we drove across the 10-mile long dike that connects the mainland to the island town of Mopti. Some fishermen were pulling in their nets in large ponds on the flood plains, and Peul nomads were herding their cattle into camps for the night.

The rough pavement of Mopti's streets was soothing, if not to my renal colic, then certainly to my spirits. I headed for the home of close friends of mine, André and Rosey Szabo, in the compound of the Water and Forest Service. André was a fisheries expert for the Food and Agriculture Organization of the United Nations, and had worked for several years with the Niger River fishermen. I crawled up the stone staircase to their house, and collapsed on their living room floor.

"You look like you are passing a kidney stone!" exclaimed



Peul woman being vaccinated against smallpox with the Ped-O-Jet injector, Kouna, Mali.

Rosey on seeing me doubled over. I had not expected such words of medical wisdom from her, but as I later learned, she was not without significant experience with renal colic, having passed several stones herself. She helped me to bed in their rear bedroom while André went to the hospital to get help. Dr. Mamadou Sissoko, the Malian surgeon there, was a close colleague of mine, and he soon appeared with a Soviet surgeon from Samarkand. They carefully examined me, said that I did not have an acute abdomen, but were certain I had renal colic. They were pleased, as I knew Dr. Dennis would have been, that I had not self-administered a narcotic.* When they finally injected me with Demerol at around 8:00 p.m., the pain disappeared, and I felt myself floating above the cliffs.

Back in Bamako, my Malian colleagues, after doing a flat plate of the abdomen, confirmed the presence of a half-centimeter radiopaque stone in the mid-ureter. However, they could not perform an intravenous pyelogram because a new supply of contrast material had not yet arrived from France. Eventually, I briefly returned to the United States, where an intravenous pyelogram demonstrated that the stone was then near the ureterovesical junction. A short time later, after numerous bouts of colic, I passed it. On analysis, it proved to be a calcium oxalate stone.

I remained in Mali for two additional years. By the time I left in early 1972, we had vaccinated 4.5 million people against smallpox, a million children against measles, and had effectively controlled epidemics of cholera, meningococcal meningitis, and yellow fever. At the end of this historic endeavor, no new cases of smallpox occurred in Mali, and eventually the

* The Mopti Hospital was then staffed by Soviet, Chinese, and North Vietnamese medical personnel, many of whom refused to treat Americans. The Vietnamese personnel had in fact collectively spit on me once on the hospital verandah. For these reasons, I went to the Szabos' home, and not directly to the hospital.

disease was eradicated worldwide.

In the decades that followed, tourists and climbers have routinely visited the Bandiagara Escarpment. Recently, I saw a television documentary on the cliffs, portions of which were shot from a helicopter. I watched in amazement as the camera effortlessly flew alongside the cliffs and brought into view the villages of Banani, Pegué, and Irieli, and the rugged canyons through which I had desperately climbed in search of help so long ago. The views were spectacular, and for the first time in three decades, I was able to enjoy them, happily devoid of anxiety, pain, and suffering.

Acknowledgments

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