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# Experience of mass casualty management - the Rana Plaza tragedy: An anesthesiologist's perspectives at a peripheral military hospital in Bangladesh

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**Abstract**

**Background:** The worst factory disaster in the history of Bangladesh occurred when a nine-storied commercial building "Rana Plaza" collapsed outskirts of the capital city. In our hospital there were no documented guidelines for dealing with mass casualty incident. Our aim was to share the experience of managing mass casualty.

**Methods:** Outcome of working experience based on four principles issues (assessment of available resources, ensuring critical but limited care, stocking up medicine and equipment for patient surge, tough rationing of decision) was assessed retrospectively. Clinical records of 155 patients were investigated. The discharge diagnosis, x-ray or computerized tomography was used for verification of injuries.

**Results:** Among 431 patients reported to emergency and casualty department, 407 (94.431%) were admitted to hospital. Among them, 155 (35.9%) required anesthesia and/or intensive care. Most of the injuries were blunt trauma and soft tissue trauma. Other injuries included fractures, head and crush injuries. Majority of surgical procedure were wound debridment, fascitomy, amputation and external fixation. Most of the surgical procedures (85%) were performed under ketamine, 22 (15%) patients received different regional techniques and only one patient received general anesthesia. Injuries requiring definitive surgery were referred to different tertiary level hospital. One patient died of lethal injuries and all the others survived. Fifty one patients survived with disability.

**Conclusions:** Anesthesiologists can improve patient care and hospital efficiency by optimizing facility utilization, surgical/anesthesia logistics, man power management, institutional communication, and leadership. Considering setup with limited workforce and equipment, management of mass casualty based on four simple principal issues might help others in managing such events.

**Keywords:** Anesthesiology; Bangladesh; Mass casualty incident; Patient care management.

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**Introduction**

Mass casualty management includes pre-established procedures for resource mobilization, field management and hospital reception. It is based on specific training of various levels of responders and incorporated links between field and health care facilities through a command post.[1] In many hospitals, pre-established procedure for mass casualty incident (MCI) managements are lacking. Problems with mass casualties are the size of situations that cannot be adequately managed simply by mobilizing more equipment, personnel and supplies.[2,3] It is recognized that lack of human resources, material resources, communication and co-ordination provide significant challenge during mass casualty events.[4,5,6]

The delivery of medical care in response to a MCI radically differs from routine procedure.[1] Anesthesiologist as expert on critical care is involved from on-the-spot first aid to intensive care unit and operating room trauma surgery. The purpose of the study is to share experience of managing mass casualty incident that is based on four principle issues (assessment of available resources, ensuring critical but limited care, stocking up medicine and equipment for patient surge and finally tough rationing of decision) in the department of anesthesiology and intensive care.

**Materials and Methods**

This retrospective study was carried out in a secondary hospital. This study was approved by our hospital authority. No informed consent was necessary as this study used existing data. This study retrospectively analyzed clinical records of the victims of building collapse (Rana Plaza Tragedy) that were treated in the Intensive Care Unit (ICU) and the Operating Room (OR). The analysis of data was done based on discharge diagnosis. X-ray and computerized tomography (CT) scan were assessed when available. Retrospective evaluation of involved manpower, material resources and structure were done with the help of hospital management records.

**Results**

In the chaotic days after building collapse more than 120 severely injured patients overwhelmed our hospital within 2 hour. Teams were organized into five groups: medical triage team, immediate care team, urgent care team, non-urgent care team, clerical team. All teams accomplished their casualty management addressing four principle issues. First issue included "assessment of available resources" which was based on three 'S'– staff, stuff and structure. Second issue included provision of "essential rather than limitless critical care" to allow additional patients to have access of life sustaining intervention during MCI. "Stocking up medicine and equipment resources" to manage patient surge was the third issue to consider. "Tough rationing of decision" with patients having life limiting illness was the final issue in management of our MCI. Among 431 patients reported to emergency and casualty department, 407 (94.431%) were admitted to hospital. Among 431 patients only 155 (35.962%) were treated in the department of Anesthesia and Intensive care (Table 1). Among 155 patients of ICU, most of their injuries were blunt trauma and soft tissue injury. Other injuries included fractures, head injuries, crush injuries etc. Majority of surgical procedure were wound debridement, fasciotomy, amputation and external fixation (Table 2). Eighty five percent (132) surgical procedure were performed under TIVA with ketamine, 22 (15%) patients under different regional techniques and only one patient received general anesthesia (Figure 1).

**Table 1: Patients Influx at Emergency Department and Admission in ICU (n =155)**

| Day | Reported at Emergency and casualty dept; n | Admitted in Hospital: n (%) | Brought dead: n | Treated in ICU: n (%) |
|---|---|---|---|---|
| 1. | 122 | 112 (91.80) | 10 | 34 (30.35) |
| 2. | 105 | 99 (94.28) | 06 | 24 (24.24) |
| 3. | 130 | 126 (96.92) | 4 | 39 (30.95) |
| 4. | 43 | 40 (93.02) | 3 | 40 (100) |
| 5. | 17 | 16 (94.11) | 1 | 08 (50) |
| 6. | 06 | 06 (100) | - | 06 (100) |
| 7. | 04 | 04 (100) | - | 00 |
| 8. | 01 | 01(100) | - | 01(100) |
| 9. | 02 | 02(100) | - | 02(100) |
| 10 to 16 | Nil | Nil | Nil | Nil |
| 17. | 01 | 01(100) | - | 01(100) |
| Total | 431 | 407 (94.43) | 24 | 155(35.96) |

With the assessment of human resources and material resource to manage casualty, two additional anesthesiologist, six surgical specialists including one orthopedic surgeon, five intensive care assistants (ICA) and six operation theater assistants (OTA) joined from nearby hospital within six hours of incident. We also received 'H' type (large size) cylinders to support manifold system (central oxygen system), central venous catheters, colloids, crystalloids, various size venous cannulae and urinary catheters etc from nearby hospitals within 24 hour of incident. We had only one functioning ICU ventilator. One available portable ventilator and anesthetic breathing

circuit was modified to serve partial purpose of ventilators in ICU. Post operative ward and recovery rooms were utilized for care of critically ill patients, though without sophisticated monitoring devices. To deal with increased operative load surgical dressing room was used as operating room but without modern monitoring capabilities. Patients were assessed and monitored by traditional physical examination: chest excursion, color, carotid pulse and manual blood pressure measurement.

**Table 2: Surgical Operative Procedure done during first seven days of incident**

| Day | Operative procedure | | | | | |
|---|---|---|---|---|---|---|
| | Major procedure | | | | Minor | |
| | Fasciotomy | Amputation | Wound debridement | External fixation of fracture | Dressing/ POP | Total |
| One | 1 | - | 6 | - | 9 | 16 |
| Two | 5 | 1 | 9 | 1 | 14 | 30 |
| Three | 3 | 1 | 6 | - | 10 | 20 |
| Four | 6 | 1 | 8 | 1 | 6 | 22 |
| Five | - | - | 2 | - | - | 2 |
| Six | - | - | - | - | 35 | 35 |
| Seven | - | - | - | - | 26 | 26 |
| Total | 15 | 3 | 31 | 2 | 105 | 155 |

Patients with Injuries that require prolonged definitive surgery were referred to different tertiary level hospital. Among 431 admitted patient, eleven patients were transferred to different hospitals for definitive treatment at earliest opportunity. Central venous line was established in nine critically ill patients with shock to provide vassopressor support. All these critical patients survived responding to aggressive critical care management. Injuries were treated conservatively to save limbs and life, such as fasciotomy (limb saving surgery).

Resupply of enough quantities of critical care items from nearby hospital ensured management patient surge on third day of incident (Figure 2).

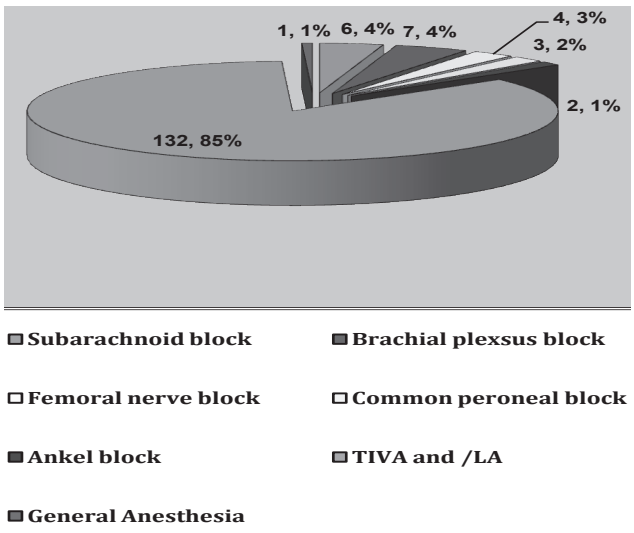


**Figure 1: Anesthetic Procedures Used in Different Surgical Procedure**

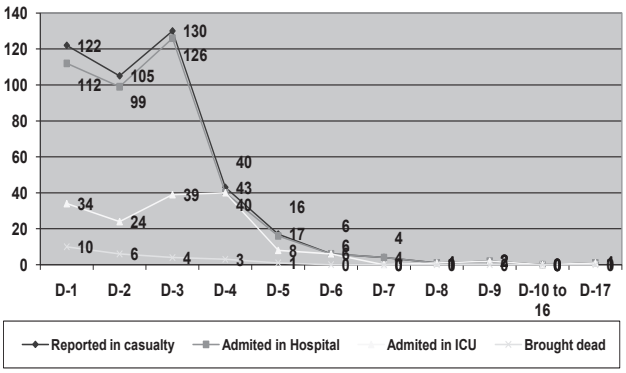


**Figure 2: Pattern of Casualty Influx at Emergency and Casualty Department**

One patient was admitted in ICU in state of shock without intravenous line with brain injury and amputated lower limbs. Because of life limiting illness of this patient, we had to take tough decision on abandoning resuscitation to do "good for the greatest number" in MCI.

**Discussion**

The philosophy of medical care in response to a mass casualty incident no longer revolves around an individual patient. Medical resources, personnel, supplies and facilities are carefully allotted to provide the greatest good to the greatest number. This study demonstrated proper assessment of both human and material resources are the first vital step in the management of MCI. We restricted ourselves in ensuring critical but limited care, ensured resupply of resources immediately and thus could manage

155 patients in short time period with limited resources. Our assessment on resources, for management of such event was based on three 'S'– staff, stuff (equipment, pharmaceuticals, and supplies), and structure (both physical structure and management infrastructure such as the Incident Command System). Amy Kaji A et al in their study demonstrated ensuring these three aforementioned essential components (staff, stuff, and structure) enhance patient-care capacity.[7]

Our hospital is approximately 30 kilometers north of capital city of Bangladesh. Our hospital is 149 Bedded secondary hospitals with limited manpower and consumable items. We had only two anesthesiologists, two surgeons, two medical specialists. Only one ICA and six OTA run ICU and OR round the clock. In an average day, 4.81 critical patients are nursed in ICU and 2.032 surgical operations were performed in OR.

There were two waves of casualties in building collapse – the Rana plaza tragedy. First wave was represented by the "walking wounded". While the early victims were arriving to the hospital, a senior anesthesiologist as specialist medical officer in charge of OR and ICU took the responsibility of organizing staff into different teams to share responsibilities. The hospital was working in a MCI mode. The second waves of casualties were those buried deeply under structural debris. They were rescued carefully and appeared later. The patients of the second wave were critically ill. This is supported by the evidence that on first day of incident only 30.35 percent patients were supported in ICU and fourth day onward almost 100 percent of reported patients were supported in ICU. Postoperative wards and recovery rooms were used as critical care area.

Workforce shortages are an ongoing challenge for most of our hospitals. Certainly reinforcement of workforce like anesthesiologist, orthopedic surgeon, OTA and ICA etc, representing staff of three S, from nearby hospital eased our effort to provide non-stop critical care support.

Current hospital reliance is on "just-in-time" and stockless material management systems to reduce storage and inventory costs.[8] It leaves institutions with vulnerably low reserves of consumables and durable medical equipment.[9] Critical care equipments are no exception. So with influx of additional critically ill patients, a hospital cannot care without resupply. Thus proper assessment of constrain and ensuring resupply of both consumable and durable equipment, representing stuff of three S, allowed to continue in average 22 surgical procedure per day.

Expansion of space for critical care and establishing a command system, representing structure of three S, is an important issue before receiving mass casualty but shortages of equipment and staffs are likely to limit this option. Expansion of hospital space for dealing with patients surge was not difficult in our hospital but enough equipment to monitor critical patient were the limit. Thus patients were assessed and monitored by traditional physical examination: chest excursion, color, carotid pulse and manual blood pressure measurement. A command system was established to ensure smooth function of health care provider in the midst of chaotic environment during MCI. Senior anesthesiologist took the responsibility and organized different staff into five different teams to share the responsibilities. One anesthesiologist was constantly present in emergency and casualty department along with one surgical specialist and medical specialist as 'medical triage team' member for the quick assessment of patients. Senior most anesthesiologist and orthopedic surgeon were involved in ICU and OT as 'immediate care team' members for the treatment of life threatening injuries. One anesthesiologist and one surgeon were responsible for treatment of patients who needed first aid or evacuation from the place of incident as and when required (urgent team). One anesthesiologist and one surgeon were working in ICU and OT as 'non-urgent care team' member for treatment of non-life threatening injuries/illness. Duty of OTA and ICA's were organized to run 3 surgical operative procedures simultaneously and continue care in ICU round the clock for 7 days. Clerical job such as documentation was assisted by medical assistant.

The concept of minimal acceptable care is the key to a staged management approach during a mass-casualty incident is highlighted in the study by Hirschberg A et al.[10] They highlighted that minimal acceptable care is the key to a staged management approach during a mass-casualty incident. We also restricted ourselves in providing essential rather than limitless critical care, to "Do the greatest good for the greatest number of people". Thus it was possible to provide critical care support of 155 patients in our department of anesthesia and intensive care over short span of time.

It is understood that patient with life-limiting illnesses would be excluded from receiving scarce critical care resources, such as; severe trauma, severe burns in certain circumstances, cardiac arrest (unwitnessed or witnessed events that don't respond to electrical therapy) etc. It is also imperative to uphold the ethical commitment to alleviate discomfort without intentionally hastening death; euthanasia is not acceptable. Thus rational approach during tough rationing of decision is also an essential element in the management of MCI.

As we had no documented procedure for managing mass casualty in our hospital, we had to work based on literature knowledge and past experience of casualty management. But working based on four principle issue has certainly eased our effort of management of MCI in the department of anesthesia and intensive care. Further study is necessary on its applicability in all type of MCI.

**Conclusion**

Anesthesiologists are well educated and experienced to manage these surges for perioperative services. By

understanding the patterns of patient injury, perioperative clinical care, and resource management during these events, anesthesiologists can improve patient care and hospital efficiency by optimizing facility utilization, surgical/anesthesia logistics, man power management, institutional communication, and leadership. The special skills of the anesthesiologist make his/her contribution to pre-hospital emergency care as well in ICU and Operating room particularly valuable. Although patients managed by number are not large but considering setup with limited workforce and limited modern equipment; management of mass casualty based on four simple principal issues might help others in managing such events.

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**Conflict of Interest Statement:** None

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