Reflections on Mushroom Poisoning in North America

By Michael W. Beug Ph.D.

In the thirty-year period of NAMA toxicology data collecting through 2005, we had received reports on a total of 126 people (averaging about 4 per year) who had eaten one of the deadly species of Amanita containing amanatoxins. Over the course of twelve months from February 2006 to February 2007, I learned of 16 incidents of potentially lethal mushroom poisoning involving 71 people who had eaten deadly species of Amanitas. There were 23 reported deaths. One of the deaths had occurred back in 2003 and 5 cases involved poisonings in Chiapas, Mexico in 2005 and 2006 that resulted in at least 18 or the 23 deaths. I normally would probably not have learned about the Mexican cases. However that still leaves 9 cases involving 44 people and 4 deaths in the U. S. and Canada during the 12 month period – ten times the average for the past thirty years. Consequently, I set out to try and estimate how good a job we are doing in learning about mushroom poisoning. I also came to some striking conclusions about the efficacy of prompt medical treatment for amanatoxin poisoning.

In Chiapas, a remote state in southern Mexico, the death rate from ingestion of "Death Caps" and "Destroying Angels" is well in excess of 50%. However, in the United States and Canada, individuals who seek prompt medical treatment have a better than 90% chance of survival. Deaths of healthy adults can typically be avoided without liver transplantation (Regenstorff, et al 2003). Currently treatment involves repeated doses of activated charcoal to remove any traces of mushroom that still may be in the system, IV fluid replacement, massive doses of Penicillin G and treatment with IV and/or oral N-acetyl cysteine. The administration of Silymarin (milk thistle extract) may be of significant benefit. Oral milk thistle extract was used in many of the treatments of mushroom poisoning in the U. S. this past year. In California in a dramatic poisoning case that began January 1, 2007, Tod Mitchell MD was able to arrange emergency approval for use of injectable Silymarin (Legalon®) flown in from Europe. Within hours of use all four of the exceptionally ill patients showed dramatic improvement in liver function (Tod Mitchell personal communication). Indeed all of the patients recovered liver function, though unfortunately the oldest patient died of kidney failure (see full report in the NAMA Toxicology Committee Report for 2006, McIlvainea in press).

In one additional 2005 case involving *Lepiota josserandii*, dialysis was used successfully. The challenge in amatoxin cases is to combat the liver damage and thus avoid a liver transplant. In one of the North American cases, a liver transplant was successfully performed. In three of the four deaths, either a liver transplant or the available of oral Silymarin may have saved the individual's life. In one (New York) case the patient refused a transplant and in a second (New York) case a liver did not become available in time. In one death (Minnesota) involving a young girl, I do not have enough information to know whether or not a liver transplant was being considered. Oral Silymarin was administered but I cannot help but wonder whether or not the availability of injectable Silymarin would have saved the two in New York and the young girl in Minnesota considering the extremely dramatic results when it was used in California.

From a combination of personal communications, literature and a lengthy Internet search, I have concluded that NAMA members are hearing about a majority of the serious mushroom poisonings and that death from mushroom poisoning is rare in countries with good medical treatment. For example in Spain from 1986 to 1988 there were 46 amatoxin poisonings (4 of which were fatal) – three died of hepatic insufficiency and a fourth died of intestinal perforation (Sanz et al 1989). The better than 90% survival rate is comparable to the U.S. and Canada. A useful Internet site (www.bio.net/bionet/mm/mycology/1995-June/002175.html) turned up a reference to mushroom poisoning in Finland. Between 1885 and 1988, 17 reported cases of mushroom poisoning that led to death. Four of these were due to *Gyromitra esculenta*, which is widely sold and eaten in Nordic countries.

In the United States, we know we have good data for the Rocky Mountain region (and Hawaii) because of Marilyn Shaw's extensive efforts. Jan Lindgren and Judy Rogers have good working relations with the Oregon Poison Center and other NAMA members around the country work to fill in information about their regions. However, California has always been a big question mark as to how good our data are. Dr. William Freedman pursues all the leads he can get but medical confidentiality makes his work extremely difficult and California is a populous state with an exceptionally long mushroom season. Consequently I was most happy to discover a paper on mushroom poisoning in California from 1993 to 1997 (Nordt and Manoguerra 2000). During that time period California Poison Control Center reports contained a total of 6,317 exposures (an average of over 1,200 per year) of which 99.7% were acute and 0.3% were chronic. Most (4,235 or 67%) involved children less than 6 years old but only 6% of these experienced clinical effects from their exposure (an average of about 50/year). In patients 6 years old and older (2082 cases), 588 (28.2%) reported vomiting, 307 (14.7%) reported nausea, 263 (12.6%) reported diarrhea, and 221 (10.6%) had abdominal pain. Sixty-one patients were admitted to critical care. However, major effects were reported in just 17 patients (0.3% of reports, average 3.4 major poisonings/year). There was one death in the five-year period, a 32 year-old who foraged cyclopeptide mushrooms (presumably *Amanita phalloides* or *Amanita ocreata*).

I also was able to contact Dr. Zane Horowitz at Oregon Health Sciences University for some additional insight on Oregon poisonings. In the fall of 1989 there was a single cluster of 5 patients of which 4 went on to have a liver transplant. There have been no transplants since and no deaths either. He estimated that they deal with fewer than 10 cases each year exhibiting evidence of elevated liver enzymes. Sandy Giffin, Department Director of the Oregon Poison Center then sent me a copy of the standard report which shows mushroom exposures for 2006 for the region served by the Oregon Poison Center (Oregon, Alaska and Nevada). Table I is created from their data.

Table I

Type	Number Exposure	<6 year	6-19 yrs	>20 yrs	Manage in HCF	No Effect	Minor Effect	Mod. Effect	Major Effect	Death
Coprine	0	0	0	0	0	0	0	0	0	0
Cyclopeptide	5	5	0	4	2	0	1	0	0	0
GI	4	1	2	1	3	2	1	1	0	0
Hallucinogenic	35	2	19	13	28	2	7	18	1	0
Ibotenic Acid	5	1	2	2	4	1	0	3	0	0
Misc nontoxic	8	4	0	4	5	2	3	1	0	0
Monomethyl-hydrazie	2	0	0	2	0	2	0	0	0	0
Muscarine	0	0	0	0	0	0	0	0	0	0
Orellanine[1]	2	0	0	2	2	0	1	0	0	0
Other potential. toxic	4	3	0	1	2	2	1	1	0	0
Unknown	216	138	40	38	40	139	31	7	0	0
Total	281	149	64	67	86	150	45	31	1	0

[1]It is not clear what poisonings are classified as due to orellanine (possibly ingestion of *Amanita smithiana*). However, actual orellanine poisonings have never been confirmed in North America.

The total for these three states (Oregon, Alaska and Nevada) is about 22% the average for California, which is about what one would expect. Children under 6 accounted for 53% of the calls to the poison center. The entry under orellanine poisoning is curious, as I have seen no confirmed orellanine poisoning reports ever in North America. It is possible that the entry might refer to ingestion of *Amanita smithiana* that was once thought to contain orellanine, but it is impossible to answer this question with any certainty. The other two striking things that I note are that the number of calls due to hallucinogenic mushrooms is a striking 12% of the total and that only one ingestion (coincidentally of a hallucinogen) resulted in a major adverse effect. The prominence of calls regarding adverse effects of hallucinogens reflects the unusual abundance of hallucinogenic mushrooms in coastal regions of Washington, Oregon and Southern British Columbia. Other regions where hallucinogenic effects would be prominent are Hawaii and the Gulf States.

Over all I am increasingly confident that while NAMA is not getting reports of all poisonings that occur in North America, we are getting a good representative sample and we are learning about the majority of deadly poisonings. The detailed summary of poisoning reports for North America in 2006 will appear in a separate paper to appear in McIlvainea in press).

References

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