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A Review on the Evolution of Agadatantra in the Indian System of Medicine: Forensic Medicine and Toxicology

Navin Kumar Shrivastava*[1] and Mayuri Saxena[2]

1, Department of Agad Tantra evam Vidhi Vaidyak, Shubhdeep Ayurved Medical College & Hospital, Indore, (M.P.) - India

2, Department of Kriya sharir, Shubhdeep Ayurved Medical College & Hospital, Indore, (M.P.) - India

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Abstract

With the progress of Indian civilization, **Agadatantra** emerged as one of the eight specialized branches of Ayurveda, the traditional Indian system of medicine, and has undergone significant development over time. This branch primarily focuses on the toxicological aspects of Ayurveda, as well as the ethical codes and guidelines for medical practice, including the professional duties and responsibilities of an Ayurvedic physician towards both patients and the state. Extensive references to Agadatantra are found in classical texts such as the *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Samgraha*, *Ashtanga Hridaya*, and *KautilyaArthashastra*. In modern Ayurvedic education, Forensic Medicine and Toxicology are taught at both undergraduate and postgraduate levels under the subject **AgadatantraVyavahara Ayurveda evumVidhivaidyaka**.

Keywords: Visha, Agada, Forensic Medicine and Toxicology

Introduction

Agadatantra, a specialized branch of Ayurveda, has evolved over centuries, integrating medical, toxicological, and legal knowledge. Despite fluctuations in focus during the Mughal and British periods, modern legislation, institutions, and research initiatives have reinforced its importance in Indian medicine.

"We can never truly master a science without understanding the history of its development."
— Charles Greene Cumston

Methodology

Conceptual study based on review ofliterature regarding Aadatantra (IndianForensic Medicine and Toxicology) fromall available literature, related web pageand related research articles.

The history of forensic medicine provides insight into the past and helps explain the present. Forensic medicine and toxicology in modern India have evolved through multiple stages, and in recent times, they have adopted the Western medical system due to British colonial influence.[1]

***Corresponding Author**
E.mail: drnavinshrivastava@gmail.com

Major Events in History with Reference to the Development of Forensic Medicine & Toxicology in India

No.	Time Period / Year	Event
1	16,000 BC	Hunters in Kenya used aconite poison to kill animals.
2	Indus Valley Civilization (3250 – 2000 BC)	Orpiment and *Aconitum napellus* used for assassination.
3	3102 BC	Manusmriti prescribed punishments for poisoning, infanticide, and illegal abortion.
4	3100 – 3000 BC	People in Egypt used poisoned arrows.
5	2737 BC	Marijuana used in China to treat gout.
6	2000 BC	Chinese Emperor Shen Nung experimented with poisons.
7	1600 BC	Smith Papyrus mentioned charms against snake poison.[2]
8	1200 – 900 BC	*Atharva Veda* described use of poisoned arrows in war; *Sthavaravisha* (irritant plant toxins) cited as major poison source.[3]
9	7th Century BC	Charaka developed antitoxic formulations, snakebite antidotes, treatments for alcohol intoxication, and used animal models for experimental toxicology.
10	6th Century BC	Kashyap successfully treated snakebite envenomation.
11	200 – 300 AD	Sushruta coined *Agadatantra* (akin to modern toxicology), classified poisons, and described antidotes, diagnosis, and medical ethics.
12	460 BC	Hippocrates advised limiting poison absorption in patients.[4]
13	399 BC	Socrates executed by hemlock (*Conium maculatum*) poisoning.
14	384 – 322 BC	Aristotle described preparation and use of poisonous arrows.
15	350 – 275 BC	Kautilya introduced fingerprint technique (*Trija*) and postmortem examination in poisoning and asphyxial deaths.[5]
16	183 BC	Hannibal committed suicide by ingesting cyanide.
17	132 – 63 BC	Mithridates VI developed the antidote "mithridatum."
18	54 AD	Locusta hired by Agrippina to poison Emperor Claudius with mushrooms (possibly arsenic).[6]
19	55 AD	Locusta poisoned with arsenic-laced soup.
20	15th – 18th Centuries	"Age of Arsenic" — favored homicidal poison due to lack of detection methods.
21	1492 – 1541	Paracelsus emphasized dose–response relationship in toxicology.
22	1663	Dr. Buckley in Madras performed India's first recorded medicolegal postmortem in a suspected arsenic poisoning case.
23	1693 (28 Aug)	First recorded autopsy in India — Dr. Edward Bulkley in Chennai on Judge Wheeler.
24	1822–1835	First medical school (Kolkata, 1822), upgraded to medical college (1835).
25	1835–1850	Medical colleges opened in Madras (1835) and Bombay (1850).
26	1849–1870	First Chemical Examiner's labs: Madras (1849), Calcutta (1853), Agra (1864), Bombay (1870).
27	1857	First Chair of Medical Jurisprudence at Madras Medical College — Dr.Urguhart appointed professor.
28	1860–1861	Indian Penal Code (1860) and Criminal Procedure Code (1861) enacted.
29	1872–1892	Indian Evidence Act (1872); Anthropometric Bureau in Kolkata

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		(1892); fingerprint classification by Herschel, Henry, Haque & Bose (1897).
30	**1898–1906**	Department of Explosives (1898); Government Examiner of Questioned Documents office (1904), moved to Shimla (1906).
31	**1915–1930**	Footprint section in Bengal CID (1915); Ballistics lab in Calcutta (1930).
32	**1920**	Dr.Jaising P. Modi published *Medical Jurisprudence and Toxicology*.
33	**1952–1957**	First State Forensic Science Laboratory (Calcutta, 1952/53); Central Forensic Science Laboratory (1957).
34	**1960**	Indian Academy of Forensic Sciences established.
35	**1971–1972**	Institute of Criminology & Forensic Science (Delhi) established; later renamed LNJN NICFS (2003).
36	**1988–1989**	Dr. Lalji Singh introduced DNA fingerprinting in India; first DNA-based case solved.
37	**2003–2005**	Poison Control Centre at Amrita Institute of Medical Sciences, Kochi established and operational.
38	**2009–2020**	Gujarat Forensic Sciences University established (2009); upgraded to National Forensic Sciences University (2020).
39	**2009**	Institute of Forensic Science, Mumbai started offering BSc, MSc, and diploma courses.
40	**2025 (May)**	NFSU Nagpur transit campus inaugurated; foundation for permanent campus at Kamptee laid.
41	**2025 (June)**	Foundation stones for NFSU campus & CFSL in Chhattisgarh; target to train 32,000 forensic experts annually.
42	**2025 (Aug)**	Central Forensic Science Laboratory inaugurated in Rajarhat, Kolkata; AI-powered forensic systems planned.
43	**2025 (Aug)**	Kannauj Forensic Science Lab (UP) became first in the state to get ISO 9001:2015 certification; UPSIFS launched advanced forensic training program.

Sequential Development

Indus Valley Civilization (3250–2000 BC) – The Indus Valley Civilization is universally recognized as being far older than the earliest written accounts of Indian history. During this era, metals and minerals such as arsenic, sulphur, mercury, lead, and copper were likely used not only for smelting and alloying, but also for preparing poisons, medicines, weapons, cosmetics, and pigments. According to the study by Gwen Robbins Schug, there is substantial evidence of injuries caused by blunt force trauma, suggesting the use of weapons such as cudgels and long clubs for assassination. Archaeological remains also reveal the presence of leprosy in ancient India and the medicinal use of orpiment in its treatment. Metallic seals were employed for preventing adulteration.

Manu (3102 BC) – Manu established numerous laws and regulations to control criminal activities. These included provisions on the legal age of marriage and punishments for offences such as rape, unnatural sexual acts, abortion, infanticide, abduction, adultery, intoxication, murder, early marriages, and physical injury. He outlined procedures for recording evidence during trials, instructing that testimonies from drunkards, the insane, the elderly, the chronically ill, children, and those of unsound mind should be disregarded.[7]

Charaka (7th Century BC) – Revered as the "Father of Indian Medicine," Charaka created a code of conduct for medical practitioners to protect the public from malpractice, laying the foundation for medical ethics in India. He detailed the role of physicians in cases of poisoning and introduced methods for early diagnosis. Poisons

were classified into *Sthavara* (from plants) and *Jangama* (from animals such as snakes, insects, venomous arachnids, and other creatures). Charaka described eight stages of poisoning and introduced the concept of *Garavisha* (artificial or mechanical poisons causing subacute or chronic toxicity) and *Dooshivisha* (cumulative toxicity). He also discussed alcohol intoxication, its medicolegal implications, assaults with poisoned weapons, and envenomation from bees, spiders, scorpions, rats, poisonous fish, and frogs.[8] Charaka recommended 24 remedial measures, including first aid, eliminative therapies (emesis, purgation, bloodletting, nasal administration), antidotes, antioxidants, cardioprotective and resuscitative therapies, and symptomatic treatment. He strongly advocated bloodletting as a toxin removal method, likening it to an early form of haemofiltration. He also promoted *Nasya* therapy, a non-invasive drug delivery method to the brain. Modern research by Ramesh Raliya et al. (2017) confirmed that nanoparticles administered nasally can cross the blood–brain barrier within 30 minutes.

Sushruta (1000–1500 BC) – Known as the "Father of Indian Surgery," Sushruta formally defined *Agadatantra*, a branch of Ayurveda equivalent to modern toxicology. He described poisons (*Visha*), their properties, modes of administration, factors influencing their action, and methods for detection. Sushruta classified poisons into *Sthavaravisha* (immobile irritant poisons, e.g., plants and minerals) and *Jangamavisha* (poisons from mobile creatures). He listed 55 types of *Sthavaravisha*, including the arsenic compound *Haratal* (orpiment), and provided stage-wise symptoms and treatments using antitoxic and antioxidant remedies. In *Jangamavisha*, he included snakes, insects, worms, spiders, and rodents, giving detailed envenomation signs and treatments. Snakebite was considered especially important—he described seven stages of envenomation and classified snakes into five families based on morphology:

1. **Darvikara** – 26 hooded, fast-moving species capable of snapping bites; venom paralyses respiratory muscles (comparable to Elapidae such as cobras).
2. **Mandalini** – 22 large-bodied species with circular markings; venom affects the blood (comparable to Russell's viper, a haemotoxic species).
3. **Rajimat** – Glossy snakes with oblique or straight body bands; venom causes rigidity, vision problems, and headache (comparable to kraits with neurotoxic venom).
4. **Nirvisha** – Non-venomous snakes, further divided into 12 species.
5. **Vaikaranja** – Crossbreeds of the above families.

Sushruta also discussed cosmetic toxicity, skin disorders, cumulative toxicity (*Dooshivisha*), and treatments such as *Dooshivishari Agada*. His texts contained moral guidelines for physicians, comparable to today's medical ethics, and included eight dedicated chapters on toxicology and its complications. He provided numerous antidote formulations, some of which have been validated by modern research. Sushruta even recognized air, water, and land pollution as causes of epidemics and proposed purification methods.

Vaghbhat (3–5 AD) – Vaghbhat detailed the mechanism of action of poisons, their properties, clinical signs in suspected poisoning cases, and the critical time frame of toxic effects. He classified poisons based on origin into two categories: plant-derived and animal-derived. According to their nature, he divided them into natural poisons and artificial/synthetic poisons, the latter termed *Garavisha*. *Garavisha* was prepared by combining substances with opposing pharmacological actions, capable of causing death immediately, after some delay, or over a prolonged period. This could correspond to dose-dependent toxicity, adverse drug reactions, or chronic poisoning. Vaghbhat also described the signs of assaults using poison-smeared weapons and recommended local wound examination for detecting toxins. Additionally, he provided detailed accounts of dog bites, symptoms of hydrophobia, and both acute and preventive treatments. He introduced numerous antitoxic formulations for snakebites and arthropod envenomation.[9]

Age of Herbo-Mineral Formulations (800 AD) – Nagarjuna, a pioneering figure in India's

metallic pharmacology, identified *Parada* (mercury) as the cornerstone of herbo-mineral preparations. He developed advanced concepts in metal pharmacology, including pharmacokinetics, biotransformation, pharmacodynamics, therapeutic uses, side effects, and toxic effects of improperly processed heavy metals and irritant plant-based formulations. He also outlined methods for therapeutic modification, purification, reduction of molecular mass, and use of adjuvants for metals. Commonly used metals in Ayurvedic medicine include *Parada* (mercury), *Tamra* (copper), *Naga* (lead), *Swarna* (gold), *Lauha* (iron), *Vanga* (tin), and *Yashada* (zinc).

Buddha Era (4th–5th Century BC) – Buddhism was founded by Prince Siddhartha Gautama (Gautam Buddha), born in Lumbini, southern Nepal. Gautam Buddha was not only a philosopher but also a physician who dedicated himself to serving humanity. Buddhism influenced Ayurveda and various aspects of human knowledge. Buddha traveled extensively across northern and eastern India, spreading his teachings through inspirational talks and logical discussions, while also embracing Ayurveda. During this period, Indian traditional medicine spread to countries like Sri Lanka, Burma, Bangladesh, Vietnam, China, Tibet, Sumatra, Taiwan, Myanmar, Thailand, Java, Cambodia, Japan, and Korea. Buddhism supported the development of Ayurveda in universities such as Nalanda and Taxila during the 5th century. King Ashoka, a disciple of Buddha, established hospitals and roadside clinics for treating poisoned patients and set up a residential medical institution at Nalanda to teach toxicology.[10]

Kautilya Era (6th–7th Century) – Kautilya emphasized the medical examination of corpses in cases of unnatural death and recommended maintaining a register of births and deaths. He prescribed ethical guidelines for physicians, comparable to modern medical ethics. Registration of physicians with the king was mandatory, similar to today's medical licensing. In his book *Arthashastra*, Kautilya outlined laws for justice, foreign policy, and civil/criminal procedures. Severe crimes such as abortion, infanticide, sexual offenses, poisoning, and murder were punishable by death. Negligence by physicians and use of secret or magical remedies were prohibited.[11]

Mughal Period (15th–16th Century) – The Mughals introduced the Unani system of medicine in India, while Ayurveda saw limited expansion. Punishments for crimes were severe, often involving physical mutilation.

British East India Company (17th Century–1947) – The British introduced modern legal procedures and Western medicine. The first recorded medico-legal autopsy in India was conducted by Dr. Edward Bulkely on August 28, 1693, for a suspected arsenic poisoning case. The first modern medical school was established in Kolkata in 1822. Ayurvedic teaching institutions were founded in Kolkata (1827, 1916) and Banaras (1922). The Indian Penal Code was enacted in 1860, followed by the Coroner Act (1871) and the Indian Evidence Act (1872). The Indian Medical Degrees Act (1916) regulated medical qualifications and penalized misuse of Western medical titles.[12,13]

Post-Independence – After 1947, India enacted the Indian Medical Council Act (1956) for Western medicine and the Indian Medicine Central Council Act (1970) for Ayurveda. The Central Council of Indian Medicine (CCIM) maintains medical registers, regulates education standards, and oversees disciplinary actions. The Drugs and Cosmetics Act (1945, amended) regulates drug manufacturing, storage, prescription, and handling of poisons. Schedule "E" lists poisonous Ayurvedic drugs from vegetable, animal, and mineral sources that can only be dispensed by registered Ayurvedic practitioners.[14]

Agadatantra (Indian Forensic Medicine and Toxicology) has significantly developed, especially post-1970. It is now included in undergraduate and postgraduate curricula, with MD (Ayu) degrees offered in the subject. The Ministry of AYUSH and CCRAS promote toxicological studies and monitor adverse drug reactions under the National Pharmacovigilance Program.

Discussion – Ancient Indians had knowledge of metals for weapons, poisons, and medicines. Manusmriti laid down legal rules, while Charaka provided a code of medical ethics akin to the modern Hippocratic Oath. Detailed classifications

of poisons (visha) and antidotes (agadayogas) were developed for diagnosis and treatment. Sushruta contributed extensively to forensic medicine, including trauma and poisons. Vaghbhat expanded knowledge on complex poisons (garavisha and doosivisha). Kautilya codified medical laws and postmortem practices. Development slowed during the Mughal and British periods but revived after independence with legislation and establishment of institutions like CCIM and the Ministry of AYUSH.

Conclusion

Agadatantra, as a specialized branch of Ayurveda, has evolved over centuries, adapting to changes in legal and medical frameworks while maintaining its importance in both traditional and modern contexts.

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