Utility of blockchains in bariatric management

Francesco Maria Carrano, MD, PhD

Department of Surgical Sciences

University of Rome "Tor Vergata", Italy

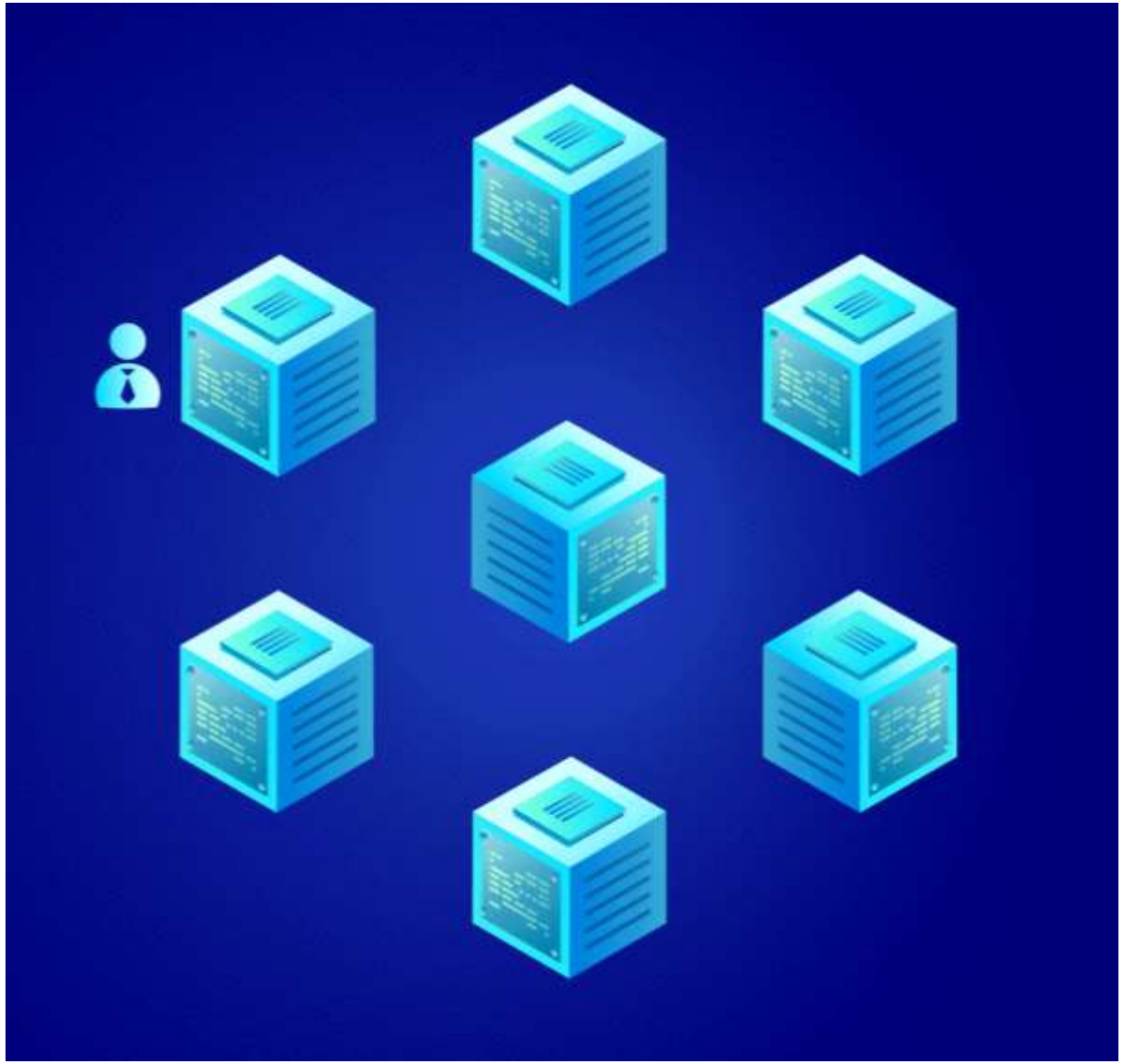
I have no potential conflict of interest to report

Outline

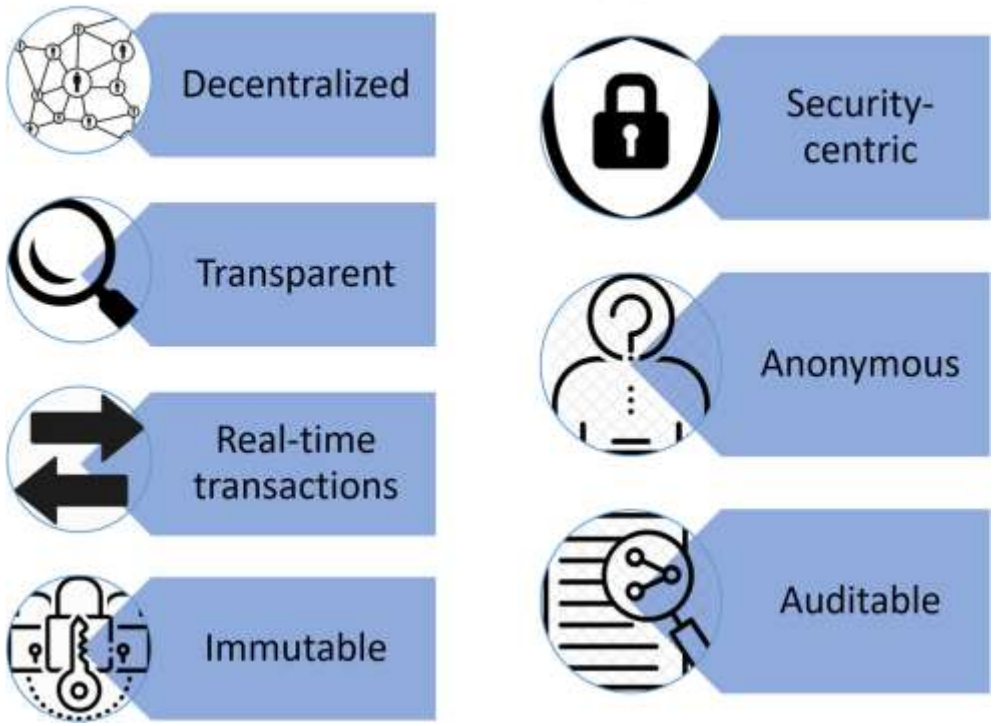
- Overview of Blockchain technology
- Potential applications in Healthcare
- Blockchain use cases in bariatric surgery
- Challenges of blockchain implementation
- Conclusions

What is blockchain technology?

Blockchain is a specific type of database that stores data in programmable blocks, chained together in a chronological order.



Key blockchain features



Decentralization: It is not controlled by a single central entity, but by a distributed network of nodes that work together.

Immutability: Once data is recorded, it cannot be modified or deleted.

Security: It uses cryptography to protect data and ensure that only the holders of private keys can access and modify information.

Transparency: All users can see the transactions that have been recorded, even if the identity of users can be protected.

Blockchain… practically

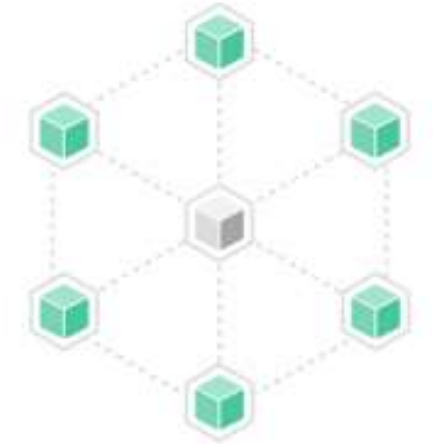
The data in a blockchain is shared and synchronized across a network.

The network's users can be distributed across multiple institutions or geographical areas.

Each network user can access, share, and replicate such data.

Any change or addition to the database is automatically mirrored in all of its copies in real time.

Blockchain….s

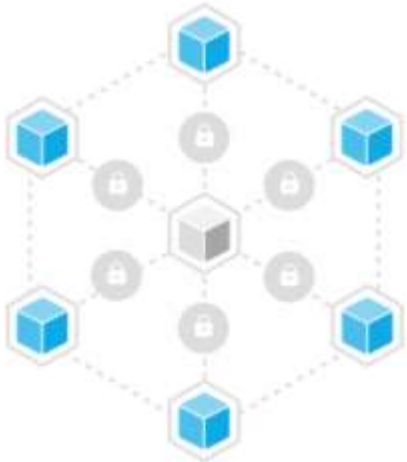


Public: open to anyone to join and participate in.

Anyone can read, write, and verify transactions on the blockchain.
Often used for cryptocurrencies (BTC & ETH).

Private: owned and operated by a single entity or group of entities.

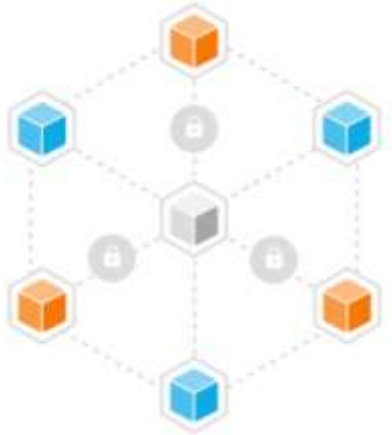
Only authorized users can participate.
Used for enterprise applications (supply chain mngmnt and recordkeeping).



Consortium: A hybrid of public and private blockchains.

Owned and **operated by a group** of **organizations**, but **anyone can participate if invited** by one of the organizations.
Often used for applications that require collaboration between multiple organizations, such as healthcare and finance.

Hybrid: combine the features of public, private, and consortium



Blockchain in Healthcare

Carrano FM, Sileri P, Batt S, Di Lorenzo N. Blockchain in surgery: are we ready for the digital revolution? Updates Surg. 2022

Blockchain in healthcare: fantasy or reality?

Smart Contracts in Healthcare Market

The smart contracts in the healthcare market is expected to register a CAGR of 16.82% during the forecast period to reach USD 5.6 Billion by 2030.

$ 5.6 Billion	16.82%	North America	2022-2030
Market Size	CAGR	Dominating Region	Forecast Period

Segmentation

By Blockchain Platform
Bitcoin
Sidechains
NXT and Ethereum
By Application
Patient Data Management
Electronic Health Records (EHRs)
Supply Chain Management
Clinical Data Exchange and Interoperability
Claims Adjudication And Billing Management)

Key Players

Companies Profiled
• IBM Corporation (US)
• Patientory (US)
• Factom (US)
• Proof.Work (UK)
• SimplyVital Health (US)
• Gem (US)
• PokitDok Inc (US)
• Hashed Health (US)
• Chronicled (US)

Drivers

Market Driving Forces
• The market growth can be attributed to the increased investment by tier 1 companies such as IBM Corporation
• SimplyVital Health
• and Microsoft Corporation

The Promise of Blockchain Technology for Bariatric Surgery

IFSO
NAPOLI
2023

Digital health passport

- Blockchain-based digital passport with all relevant info (medical history, Rx, videos, etc.)
- Info stored on the blockchain → easily accessed by HCP and researchers
- Used to access a private network for patients to share their experiences with bariatric surgery. Patients would connect with each other and provide mutual support 💪

Blockchain Informed Consent

Improved informed consent process:
transparent, secure, efficient, and compliant

Automatic generation of consent forms:
↓errors and ↑ efficiency

Tracks IC forms authenticity: **prevents fraud** and ensures that patients are only consenting to procedures that they have actually agreed to.

New ways of informed consent, with audio and video, not necessarily the forms we use now

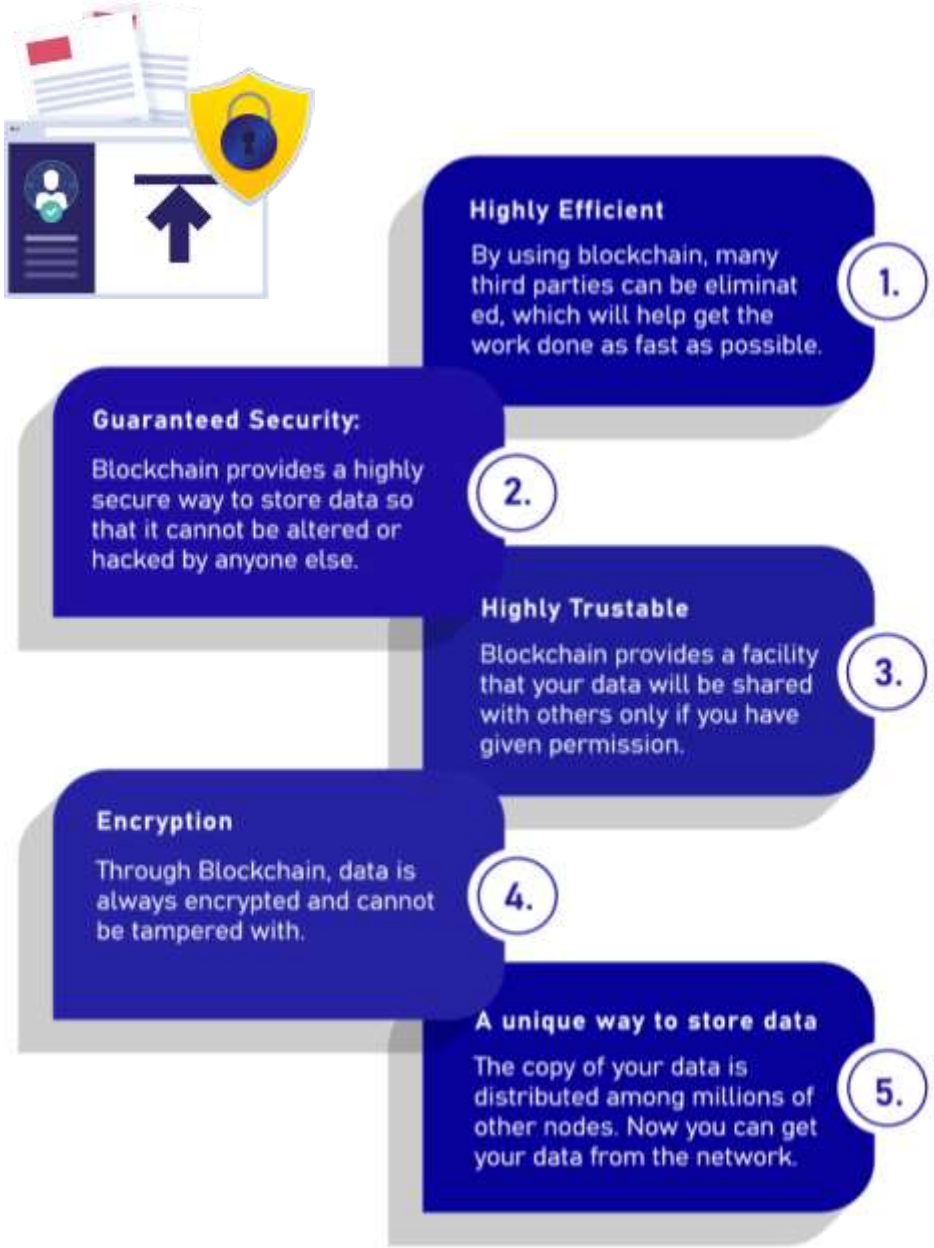
Blockchain Informed Consent

A **secure** and **reliable** way to store and manage consent forms and medical records → tamper-proof and secure

Consent forms would always be:

- Accurate and up-to-date, compliant to regulations
-  patient, the surgical team, and all necessary parties
- **Smart contracts** can be used to **automate** the IC process.
- Potentially improve efficiency & security

↓risk of medical malpractice lawsuits.



Tracking the supply chain for bariatric surgery equipment and supplies

J&J Unit Wins Block Against Seller Of Counterfeit Implants

October 2, 2020

By Hannah Albarazi LAW360

"According to scientific analyses conducted at plaintiffs' direction, the counterfeits do not work, are bacterially contaminated, and pose serious risks to the health and lives of patients," U.S. District Judge Robert M. Dow Jr. wrote in his order Friday, requiring the Illinois company Advanced Inventory Management Inc., which does business as eSutures.com, to immediately stop selling, purchasing, distributing or otherwise using products wit the Ethicon mark, real or fake.

Surgical supplies and equipment must be HQ and free of defects

Immutable **record** of the movement of surgical supplies and equipment throughout the supply chain, **from production to the OR**

Verifiable assurance that surgical equipment is original, safe, effective, and HQ, **↓ risk of scams**.

↓ inefficiencies in the supply chain

Real-time tracking of availability in hospitals and manufacturers

Automated ordering of equipment based on actual needs

Ensures that the necessary tools are always available

Improving patient outcomes

- Remote patient monitoring
- Wearable devices are provided to the patient at discharge for remote monitoring (e.g., heart rate, blood pressure, blood sugar, hemoglobin, etc.)
- Connected to the blockchain → secure and accurate real-time tracking of patient data

- **Smart contracts** used to activate alerts when certain conditions are met:
- Onset of Afib → automatic notification to cardiologist
- Sudden decrease in hemoglobin →

Winner of the "HealthChainHack" project in 2019

Losing weight as a serious game

Gamification of the weight-loss journey: pts earning points & rewards for completing tasks and milestones pre/post-op → process more fun and engaging.

Rewards system: pt rewarded for completing tasks (i.e. attending appointments, losing weight, following the diet, etc).
The rewards could be points, badges, or other virtual items.

Competitions: pts could compete with each other to see who can lose the most weight or who can make the most progress in their recovery → help motivate patients and keep them engaged in the process.

Enhancing Bariatric Surgery Research

- **Secure Data Sharing:** Researchers from different institutions can **securely share anonymized patient data** on a blockchain.
- **Traceability of Patient Data:** audit trail of patient data, ensuring that the research data is accurate and unaltered. Transparency **↑credibility** of research findings and **↓ risks of data manipulation**.
- **Clinical Trials:** Blockchain can streamline the process of recruiting patients for clinical trials
- **Smart contracts** could automate eligibility criteria, informed consent, and compensation → more efficient trial process.

Enhancing Bariatric Surgery Research

- **Data Integrity:** research data is tamper-proof and remains unchanged → researchers confident in the integrity of their findings.
- **Collaboration and Data Sharing:** International collaborations can benefit from blockchain's decentralized nature.
  Researchers across 🌐 securely share findings.
- **Patient-Reported Outcomes:** Patients can directly input their post-operative experiences and outcomes → collecting valuable real-world data for analysis.
- **Intellectual Property Protection:** Researchers can protect their innovations by timestamping their work on a blockchain, establishing a clear record of ownership and creation.
- **Funding Transparency:** providing an auditable record of financial transactions, ensuring accountability and reducing concerns of biased research outcomes.

Blockcha..llenges

Not so easy…

Scalability issues

- New technology → may not support the large volumes of data generated in the surgical/healthcare field
- Limited transactions/contracts processed per second → usage times may not be compatible with surgical activity, where time is essential
- Blockchain might struggle with vast patient health data, including clinical-lab info, images, surgery videos, and supply chain data

Possible solutions:

- New blockchain protocols designed for the healthcare sector (e.g., Hyperledger Fabric, Corda) → increase scalability, interoperability between systems, and improve privacy management
- Use of **"sidechains"** to reduce the workload on the main chain → faster and more efficient transactions
- Sharding → partitioning the network into many small fragments to improve scalability

Privacy and security concerns

With data distributed everywhere, ensuring the anonymity of health data is essential

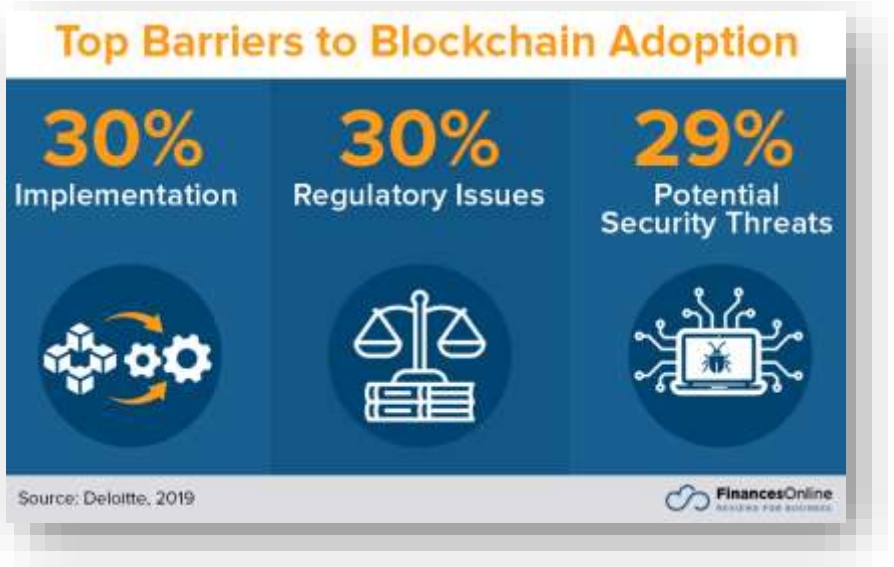
Blockchain is highly secure and immutable but **not inherently anonymous** → all transactions are publicly visible and could be traced back to the source

Health data could be accessible and potentially visible to anyone with access to the blockchain

Possible solutions:

- Implementation of privacy features such as "zero-knowledge proofs" or "homomorphic encryption" → private and **secure transactions without revealing their content**
- Use of private blockchains → provide control on who has access to data and prevents unauthorized access.

Adoption and implementation barriers



- **Regulators:** Healthcare is a highly regulated field → difficult integration between legal and technological fields
- **Interoperability:** Potential difficulty in integrating current management software with blockchain-based solutions to ensure data exchange between different platforms
- **Implementation:** Resistance to change and cultural barriers of HCPs & pts (e.g. due to security and privacy concerns)
- **Technical expertise:** Lack of qualified or experienced personnel in blockchain technology
- **Initial implementation costs:** Could be initially high, reducing cost/benefit ratio (e.g. system maintenance costs, auditing, cryptographic system updates, etc.)

Cryptocurrency crash

- Impact on blockchains that use them
- Blockchain tech designed not to rely exclusively on a specific cryptocurrency → multiple crypto and tokens can be used interchangeably
- The value of the technology goes well beyond its use as a cryptocurrency in the financial sector
- Even in the event of a crypto crash, blockchain technology would remain a valid solution for several sectors, including healthcare.

Blockchains in bariatric management

01

Blockchain-based solutions could allow a new way of surgeon-patient interaction → remote monitoring, e-health passport, informed consent

02

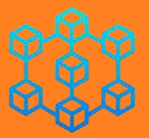
Active involvement of patients in research

03

Open challenges: privacy concerns, regulatory uncertainty, and the initial high cost of implementation.

04

The potential benefits of blockchain technology make it a promising area for future research and development.



Why should surgeons care about blockchain?

“If you don't understand the technology you are using, you will be its slave rather than its master”

Alan Kay

Thank you!

Any questions?

@FMCarrano

https://www.linkedin.com/in/Dr-Carrano