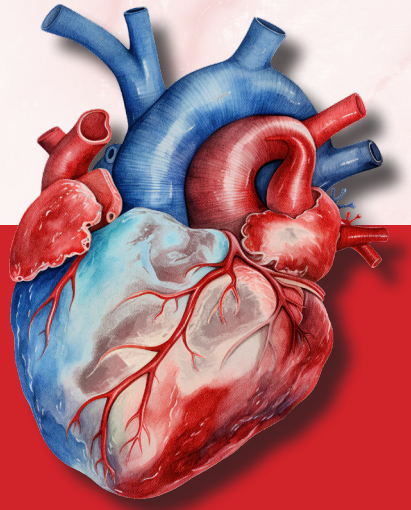
CİLT 1



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ÖNSÖZ

Kalp damar cerrahisi, sağlık bilimlerinde insan yaşamının en kritik anlarında devreye giren, hem bilimin hem de insanlığın en ince çizgide buluştuğu bir disiplindir. Ölümlerin hala en sık nedeninin, kardiyovasküler hastalıklar olması önemini daha da artırmaktadır. Yorucu ve meşakkatli bir uzmanlık alanı olan kalp damar cerrahisini tercih edenler çalışkan, özverili ve yüce gönüllü hekimlerdir.

Bir asıra yaklaşan ulusal kalp damar cerrahisi eğitimimizle tanı ve tedavide çağdaş, evrensel ve çok iyi sonuçlara ulaştık. Bir ülkenin gelişmesi ancak bilim ve fenle mümkündür ve bu bağlamda ana dilde öğretimin rolü yadsınamaz. Bilim alanımızda özgün, ana dilimizde deneyimlerimizi de katarak bir kalp damar ve cerrahisi kitabı yazma görevimize 2000 lerin başında karar verdik. 3. Basımını çıkardığımız bu özgün eseri Türk bilim hayatına sunmanın onurunu yaşıyoruz.

Her ameliyat, yalnızca teknik becerinin değil; sezginin, deneyimin, sorumluluğun ve en önemlisi irfanın bir bileşkesidir. Çünkü "bilimde irfan olmazsa olmaz" – bilgi, ancak yüksek değerlerle birleştiğinde gerçek anlamını bulur ve insan hayatına dokunan bir değere dönüşür. Kalbin gönülle eş anlamlılığı bu eserin verilmesinde bizlere ayrıca bir motivasyon sağlamıştır.

Eserimizin tüm kalp damar ve kardiyoloji camiası, öğrenci, asistan, uzman ve öğretim görevlileri için iyi rehber olacağına inanıyoruz. Amacımız yalnızca güncel bilgi sunmak değil; aynı zamanda bu bilginin ardındaki düşünceyi, vizyonu ve mesleğin ruhunu aktarmaktır.

Kalp damar cerrahisi, teknolojiyle iç içe gelişen, her gün yeni tekniklerle ve inovasyonlarla zenginleşen bir alandır. Robotik cerrahiden yapay zekânın yönlendirdiği karar destek sistemlerine, minimal invaziv yaklaşımlardan biyomühendislik ürünlerine kadar genişleyen bu dünyada, yalnızca bilmek yetmez yenilikleri sorgulamak, anlamlandırmak ve geleceğe uyarlamak gerekir. Bu kitap, bu yolculukta sizlere hem güvenilir bir bilgi kaynağı, hem de vizyon kazandıran bir rehber olmayı amaçlamaktadır.

Bu kitabın gerçekleşmesinde büyük katkıları olan akademisyen kitabevine, değerli editörlerimize, sayın yazarlarımıza teşekkürlerimizi sunuyoruz. Bölüm yazarları, hem klinik bilgi birikimlerini hem de mesleki deneyimlerini cömertçe paylaşarak bu eseri ortaya koymuşlardır. Her biri, kalp damar cerrahisinin yalnızca bir uzmanlık alanı değil; bir duruş, bir adanmışlık ve insanlığa hizmet sorumluluğu olduğunun bilinciyle katkı sunmuştur.

Bizi yetiştiren büyüklerimize, hocalarımıza, bu yüce meslekte bize fedakarca katlanan ailemize şükranlarımızı sunuyoruz. Yaşamını kaybeden meslektaşlarımızı ve önceki yazarlarımızı şükran ve rahmetle anıyoruz.

Bilim anlam, değer ve erdemlilikle taçlandırılırsa gönülden içerikler sunar. Kalp damar cerrahisinin geleceği, bilgiyle yoğrulan ellerinizde, irfanla aydınlanan yolunuzda daha da güçlenecektir.

Prof. Dr Mustafa PAÇ

ÖNSÖZ

Konjenital kalp cerrahisi, doğuştan kalp anomalilerinin tanı ve tedavisinde multidisipliner yaklaşımı zorunlu kılan, yüksek düzeyde uzmanlık ve deneyim gerektiren bir alandır. Bu kitap, alanın güncel bilimsel birikimini sistematik bir çerçevede sunmayı, klinik uygulamaya yönelik kanıta dayalı bilgiyi derlemeyi ve konjenital kalp cerrahisinde karşılaşılan karmaşık klinik sorunlara kapsamlı bir rehber oluşturmayı amaçlamaktadır.

Kitabın hazırlanma süreci, farklı merkezlerden çok sayıda değerli yazarın bilimsel katkılarıyla zenginleşmiştir. Her bir bölüm, yazarlarının klinik deneyimleri, literatüre hâkimiyetleri ve akademik titizlikleri doğrultusunda özenle oluşturulmuş; böylece konjenital kalp cerrahisinin tüm yönlerini kapsayan bütüncül bir yapı ortaya çıkmıştır. Bu kolektif emek, kitabın hem eğitim hem de klinik karar süreçlerinde güvenilir bir başvuru kaynağı olma niteliğini güçlendirmektedir.

Bu eserin ortaya çıkmasında, bilimsel yaklaşımını ve editoryal desteğini süreç boyunca titizlikle sürdüren baş editörümüz Prof.Dr. Mustafa Paç' a teşekkür etmek isterim. Kendilerinin vizyonu, yönlendirmeleri ve yapıcı değerlendirmeleri, kitabın akademik bütünlüğünün sağlanmasında belirleyici olmuştur.

Ayrıca katkı sunan tüm bölüm yazarlarına, bilimsel doğruluğu önceleyen yaklaşımları ve yoğun çalışma tempolarına rağmen gösterdikleri özveri için teşekkür borçluyum. Son olarak üzerimde büyük emeği olan, bu projede görev almama vesile olan, konjenital kalp cerrahisinin duayeni sayın hocam Prof.Dr. Tayyar Sarıoğlu' na minnettarlığımı belirtmek isterim.

Bu kitabın, klinik pratiğe anlamlı bir katkı sağlaması ve konjenital kalp cerrahisi alanındaki bilimsel gelişime destek vermesi en büyük dileğimdir. Değerli meslektaşlarımızın ve cerrahi uzmanlık yolculuğunda ilerleyen genç hekimlerimizin dikkatine sunulan bu kapsamlı eserin hazırlık sürecinde yer almaktan onur duyuyorum. Konjenital Kalp Cerrahisi alanında, güncel bilgi birikimini ve cerrahi tekniklerin inceliklerini bir araya getiren bu kitabın, alanındaki en önemli başvuru kaynaklarından biri olacağına yürekten inanıyorum.

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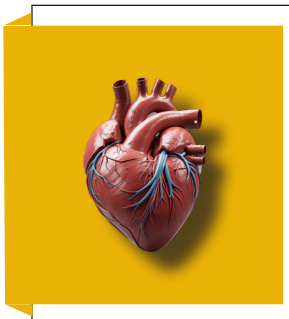

KALBİN CERRAHİ ANATOMİSİ

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1

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Göğüs Kalp ve Damar Cerrahisinde ilk ve en çok kitap yazan kıymetli Hocamız Hasan SOLAK'ı saygı ve minnetle anıyoruz.

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KLİNİK SONUÇLAR VE LİTERATÜR VERİLERİ

Mitral kapak cerrahisinde yapılan geniş serili çalışmalarda, robotik yaklaşımın mortalite ve morbidite açısından güvenli olduğu ve klasik cerrahiye göre benzer sonuçlar sağladığı bildirilmiştir (25). Chitwood ve arkadaşları, 540 hastalık serilerinde robotik mitral kapak tamirinde %95 başarı oranı ve düşük revizyon oranı raporlamıştır (26).

GELECEK PERSPEKTİFİ

Yapay zekâ entegrasyonu, artırılmış gerçeklik sistemleri, teletıp yoluyla uzaktan cerrahi gibi gelişmeler, robotik cerrahinin geleceğini şekillendirecektir. Ayrıca taşınabilir ve daha uygun maliyetli robot sistemlerinin gelişmesiyle, daha fazla merkez bu teknolojiye erişebilecektir (27).

SONUÇ

Minimal invaziv ve robotik kalp cerrahisi, uygun hasta grubunda komplikasyonları azaltan ve iyileşme sürecini hızlandıran etkili yöntemlerdir. Gelecekte bu tekniklerin yaygınlaşması, hasta konforunu ve klinik sonuçları daha da iyileştirecektir.

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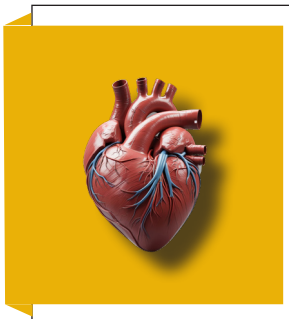

KARDİYOVASKÜLER FONKSİYON VE FİZYOLOJİ

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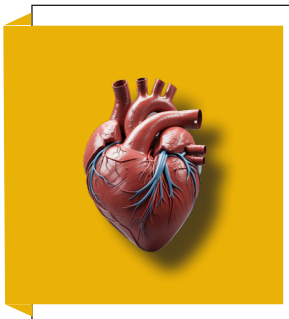

KLİNİK KARDİYOLOJİNİN BİYOLOJİK TEMELLERİ

BÖLÜM

3

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miştir. Hücre stresi, kalp cerrahisinin doğrudan etkilediği fizyolojik bir süreçtir. Plazma membranı, mitokondriler, iyon kanalları ve protein sentezi gibi sistemler stres yanıtında birlikte rol alır. Hücreler, kısa süreli streslere karşı stres proteinleri ile adaptasyon geliştirirken, uzun süreli ve yoğun stres durumlarında bu yanıt yeterli olamaz ve hücre ölümü kaçınılmaz hale gelir.(49) Cerrahi stratejilerin bu süreci azaltacak şekilde planlanması, **koruyucu hemostazis** kavramının temelini oluşturur.

Klinik ortamda, iskemi ile ilişkili arterin revaskülarizasyonundan sonra reperfüzyon hasarı, miyokardiyal sersemleme, reperfüzyon aritmisi, miyozit ölümü, endotel ve mikrovasküler disfonksiyonla birlikte 'no-reflow fenomeni' ile kendini gösterir.(50)

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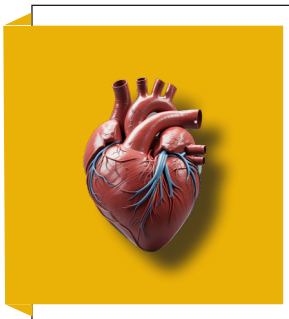

KALP CERRAHİSİNDE FARMAKOLOJİK YAKLAŞIM

BÖLÜM
4

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cerrahisine girecek hastalarda oral antikoagülanların etkisini döndürmek için kullanılır. Üç ve dört faktörlü konsantreler mevcuttur ve dört faktörlü konsantreler Faktör II, VII, IX, X 'un yanısıra protein C, S, antitrombin ve heparinden oluşur.(158) Taze donmuş plazmaya göre daha güvenli ve hızlı bir şekilde antikoagulasyonu döndürür.(297) Kalp cerrahisi ve diğer cerrahi işlemlerde kalıtsal veya antikoagulana bağlı olmayan kanamanın kontrolünde de potansiyel değeri olduğu ileri sürülmektedir.(298)

K vitamini antagonistlerinin döndürülmesinde kullanıldığında INR düzeyine göre doz belirlenir.

Kalp cerrahisi sonrası kanamada tedavi planı

1. Cerrahi kanamanın kontrol edilmesi
2. Ek doz protamin uygulanması (0.5-1 mg/kg) (ACT>150 veya aPTT>1.5 kat ise).
3. Vücut ısısı 35°C'nın altındaysa hastanın ısıtılması
4. PEEP uygulaması (hipovolemi yoksa uygulanır) mediastende tamponad etkisi yaratabilir, kontrollü çalışmalar yoktur
5. Traneksamik asit 10-20 mg/kg. D-dimer >1.0 mg/ml Fibrin yıkım ürünleri > 40 mg/ml ve tromboelastogramda gözyaşı damlası şeklinde trase varsa uygulanır. Profilaktik olarak başlanır. Kompleks olmayan cerrahilerde indüksiyonda bolus doz uygulaması yeterli olabilirken kompleks cerrahilerde cilt kapanıncaya kadar infüzyon yoluyla uygulanır. Doz böbrek disfonksiyonunda azaltılır.
6. Trombosit transfüzyonu, trombosit sayısı < 100 000/mm3 ise 1 Ü/10 kg trombosit süspansiyonu verilir. Aspirin, klopidogrel veya prasugrel'e bağlı olduğu düşünülen kanamayı yönetmek için de kullanılır.
7. Taze donmuş plazma, PT veya aPPT>1.5 kat uzamış ise ve INR 1.5 'in üzerinde ise 15 ml/kg verilir.
8. Kriyopresipitat veya fibrinojen verilebilir. Fibrinojen düzeyini 150mg/dL üzerine çıkarmak için 1 Ünite / 4 kg verilir.

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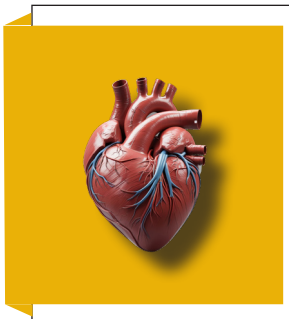

ERİŞKİN KALP CERRAHİSİNDE ANESTEZİ

BÖLÜM
5

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geçtiği kaslar arasına lokal anestezik enjeksiyonunu içerir, sinir hasarı ve nöraksiyel hematom gibi komplikasyon riskleri önlenebilmektedir(53). Pek çok blok tanımlanmıştır; pektoral bloklar I-II, serratus anterior plan bloğu, yüzeyel-derin transvers torasik plan bloğu, pektointerkostal fasyal plan bloğu, erektör spina plan bloğu, romboid interkostal subserratus plan bloğu gibi.

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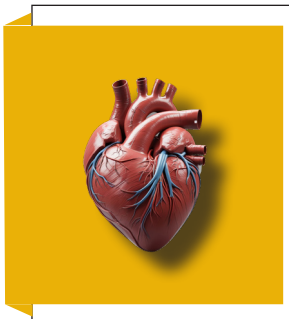

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değerlendirmeleri ve ekip tartışmaları, potansiyel risklerin belirlenmesine ve kişiselleştirilmiş bakım planlarının geliştirilmesine yardımcı olur. Ameliyat sırasında sürekli iletişim, her ekip üyesinin işlemin ilerleyişini ve gerekli ayarlamaları bilmesini sağlar. Bu iş birliğine dayalı yaklaşım, her hastanın en uygun ve etkili tedaviyi almasını, sonuçların optimize edilmesini ve hasta güvenliğinin sağlanmasını sağlayarak ekip performansını artırır ve hasta merkezli bakımı güçlendirir.

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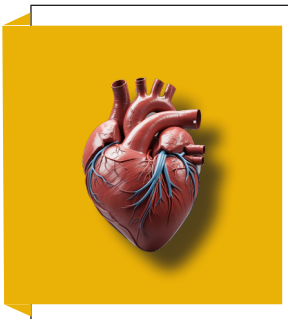

KALP CERRAHİSİNDE MİYOKARD KORUMASI

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7

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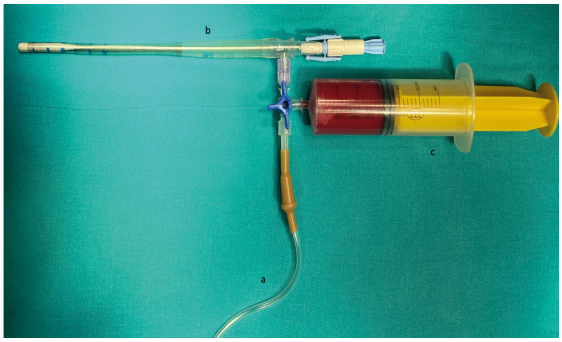

Resim 6. *Yedi kilogram altı hastalarda uyguladığımız kardiyopleji hazırlama sistemi a) dışarıda steril olarak hazırlanan kardiyopleji solüsyonun bağlantısı b) KPB hattından kan aldığımız aort kanülü c) kardiyopleji solüsyonlarının karıştırıldığı enjektör.*

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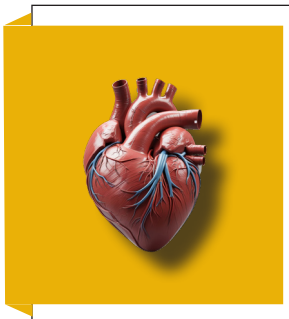

KALP KATETERİZASYONU VE KORONER ANJİYOGRAFİ

BÖLÜM

8

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Pulmoner Arter Pulsatilite İndeksi (PAPi): PAPi, sağ ventrikül fonksiyonunu değerlendirmede kullanılır; düşük değerler RV yetmezliğini gösterir ve LVAD sonrası RV yetmezliği riskini öngörmede önemlidir. PAPI <1,85 olan hastalarda risk yüksektir (9)

Sağ Ventrikül Atım İşi İndeksi (RVSWI): RVSWI, sağ ventrikülün pompalama kapasitesini yansıtır; sağ kalp yüklenmesini ve fonksiyonunu değerlendirirken kullanılır.

İntrakardiyak Şantlar

Sistemik kanın venöz dolaşıma karışmasına soldan sağa, venöz kanın sistemik dolaşıma karışmasına sağdan sola şant denilmektedir. Konjenital veya edinsel lezyonlar sonucu şant oluşabilir. Normalde pulmoner kan akımı sistemik akıma eşit iken soldan sağa şantta pulmoner kan akımı, sağdan sola şantta sistemik kan akımı daha fazla olacaktır.

Eskiden intrakardiyak şantların tesbiti ve değerlendirilmesi sadece kateter laboratuarında yapılırken, günümüzde transtorasik ve transözafageal ekokardiyografideki gelişmeler ile invaziv değerlendirme oranı giderek azalmıştır.

Arteriyel oksijen satürasyonunun %95'in altında olması sağ-sol şantı, pulmoner arter oksijen satürasyonunun sistemik venden yüksek olması sol-sağ şantı düşündürür. Şantın yerinin ve yönünün değerlendirilmesi için vena cava superior ve inferior'dan, sağ artiumun üst, orta ve alt kısımlarından, sağ ventrikül girişi, apeksi ve çıkış yolundan, pulmoner arter ve dallarından, girilebiliyorsa sol atrium ve pulmoner venlerden ayrıca sol ventrikül ve aortadan kan örnekleri alıp oksijen satürasyonlarına bakılmalıdır. Bu satürasyon değerlerinden Fick prensibine göre pulmoner ve sistemik kan akımları hesaplanıp, şant miktarı bulunabilir.

$$\text{Akımlar oranı (Qp/Qs)} = \frac{\text{Arteriyal O2 \%- miks venöz o2 \%}}{\text{Pulmoner ven O2 \%- Pulmoner arter O2 \%}}$$

Bu formülde Qp: pulmoner kan akımı, Qs: sistemik kan akımını gösterir.

Oksijen satürasyonunda bir "basamak atlama step up" soldan sağa şantı ifade eder, atriyal düzeyde >%7, ventriküler ve pulmoner arter seviyesinde >%5 artması ciddi şant anlamına gelmektedir (1).(Tablo 4)

Tablo 4. Şant değerlendirmesinde oksimetre. (%O2 sat, "step-up" Şant tesbiti)

Yer	maksimum	ortalama
VCS-VCI/RA	>11	>7
RA/RV	>10	>5
RV/PA	>5	>5

VCS: vena cava superior; VCI: vena cava inferior; RA: sağ atrium; RV: sağ

İşlem sonrası bakım

İşlem bittikten sonra kılıf çekilir. İlk yapılan anestezik maddenin etkisi geçmişse yeniden bir miktar verilebilir. Kılıf çekildikten sonra kanama kontrolü genelde direkt olarak manuel basınç uygulanarak yapılır. Eğer hem arteriyel, hem venöz kılıf varsa, öncelikle venöz kılıfı çekmek uygun olur. Kılıflar çekildikten sonra yaklaşık olarak 6 saatlik yatak istirahati gereklidir.

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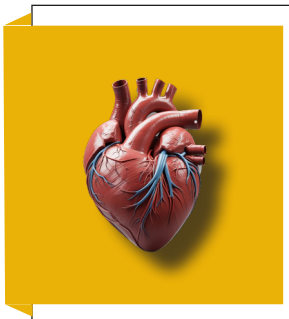

EKOKARDİYOGRAFİ

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9

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Kalp kapaklarında 3B-E'nin iki boyutlu ekokardiyografiye üstünlükleri vardır. Özellikle de TEE ile birleştirildiğinde 3B-E ile kalp kapak anatomisi ve fonksiyonunun değerlendirilmesi benzersiz "cerrahi bakış açısı sağlar. Mitral kapak skallopları ve prolabe segmentlerin saptanmasında ve özellikle de protez kalp kapaklarının değerlendirilmesi, tromboz(106), pannus(107), ayrışma(108) görüntülenmesi 3B-TEE ile mükemmele yakın sonuçlar vermektedir (Şekil 16-18). 3B-TEE mitral kapaklarda mükemmel bilgiler verirken, anteriyor yerleşimli olan triküspit(109) ve aortik kapaklarda görüntüleme sınırlıdır.

Girişimsel işlemlerde 3B-TEE, işlem başarısını ve güvenilirliğini arttırmak amacıyla yaygın olarak kullanılmaya başlanmıştır. Bunlar içinde, ASD (Şekil 19), PFO, VSD, paravalvuler mitral yetersizliğin perkütan kapatılması (Şekil 20) 3B-TEE'nin en sık olarak kullanıldığı işlemlerdir. Özellikle ASD kapatma cihazının ebat belirlenmesi sırasında sirküler olmayan defektlerin çapları iki boyutlu TEE ile hatalı olarak ölçülebilmekteyken, 3B-TEE ile bu sorun ortadan kalkmıştır (Şekil 21). Ayrıca defekt rimlerinin yeterliliği ve defektin komşu yapılarla ilişkisinin direk olarak belirlenmesi mümkündür. Mitral balon valvuloplasti uygulamasının hemen ardından kapak alanı hesaplanmasında PHT yöntemi güvenilir olmayan sonuçlar verirken, 3B-E ile kapak alanı cerrahi bakış açısıyla daha doğru olarak saptanabilir. Bunun dışında, 3B-E intrakardiyak kitlelerin komşu yapılarla ilişkisi, tutunma yerinin görüntülenmesi ve cerrahi planlamasında mükemmel anatomik detaylar sunar. 3B-E'nin renkli Doppler ile birleştirilmesi günümüzde 4-7 kardiyak siklüs ve elektrokardiyografi aracılığıyla "full volüm" yöntemiyle mümkün olabilmektedir. Bu sayede regürjitan jetlerin çıkış yeri, hemodinamik hesaplamalar, kaçak derecesi ve hacmi güvenilir şekilde hesaplanabilir.

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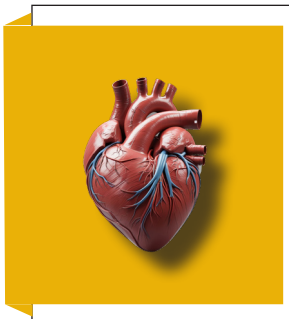

MİYOKART CANLILIĞI

BÖLÜM
10

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SVF'u olan hastalarda (EF ≤ %35) işlem sırasında ölüm riski yüksektir Ortalama EF %24,7 olan ciddi SVF'u olan ve 26 gözlemsel çalışma 4119 hastayı .içeren bir meta-analizde bypass için kabul edilebilir mortalite %5,4; %95 GA (%4,5-%6,4) ve 5 yıllık sağ kalım %75 bulunmuştur (70). Canlılık testleri başarılı revaskülarizasyon olasılığını arttırmaya yöneliktir. İskemi, canlılık ya da mikrovasküler hastalık araştırılıyorsa ilk basamak olarak fonksiyonel görüntüleme seçilmelidir. Fonksiyonel görüntüleme testleri yaygın koroner kalsifikasyonları olanlarda, atriyal fibrilasyon gibi düzensiz ya da taşikardisi olan yaşlı hastalarda, renal yetersizlik veya iyotlu kontrast alerjisi olanlarda KBT yerine tercih edilmelidir. Revaskülarizasondan yarar görmeyeceği düşünülen, ciddi komorbiditesi veya frajilitesi olan veya çok düşük yaşam kalitesi olan ve hepsinin sınırlı yaşam beklentisine katkısı bulunan hastalarda KKS tanısı klinik olarak konulabilir ve sadece medikal tedavi uygulanarak yaşam tarzı değişiklikleri önerilir.

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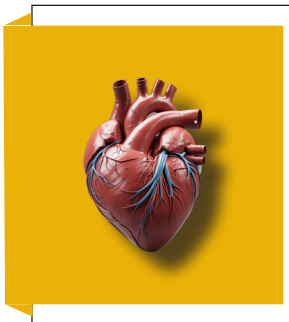

KORONER ARTER HASTALIKLARININ TANISINDA GELİŞMELER

BÖLÜM
11

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olgularının tanısı için uygulanacak test seçilirken hastaya dayalı risk-fayda analizi mutlaka yapılmalıdır. Koroner BTA, akut koroner sendrom ile acil servise başvuran KAH yönünden düşük ve orta riskli olgularda koroner arter lezyonlarının değerlendirilmesinde ilk basamak testi olarak önerilmektedir. Koroner arterlerde oklüzif lezyonların miyokard perfüzyonuna fonksiyonel etkisini değerlendiren hibrid SPECT /BT, PET/BT ve PET/MR görüntüleri uygun sağaltımın planlanması ve prognoz belirlenmesinde yardımcıdır. Kardiyovasküler MR ile kardiyak yapı ve ventriküler fonksiyonların değerlendirilmesi yanısıra kalp dışı vasküler lezyonların saptanması mümkün olacaktır.

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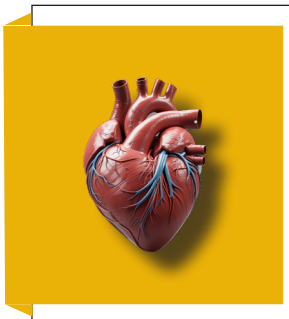

KALP HASTALIKLARINDA KARDİYAK BT

BÖLÜM
12

Önder ERASLAN [1]

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de önemli bir rol oynamaktadır. Bu çok yönlülük, BT'yi tek bir taramada birden fazla klinik soruyu yanıtlayabilen bir modalite haline getirmektedir.

Geleceğe bakıldığında, yapay zeka ve ileri analitiklerin entegrasyonu, kardiyak BT'nin potansiyelini daha da artırmaktadır. FFRct gibi BT kaynaklı fonksiyonel değerlendirmeler, girişimsel işlemlere olan ihtiyacı azaltırken, makine öğrenmesi algoritmaları tanı ve prognostik görevlerin otomatikleştirilmesini sağlamaktadır. Bu teknolojik sinerji, kardiyak BT'yi sadece bir görüntüleme aracı olmaktan çıkarıp, bir prediktif tıp ve klinik karar destek platformuna dönüştürmektedir. Sonuç olarak, kardiyak BT'nin kardiyolojinin birçok alanında temel bir role sahip olduğu ve bu rolünün sürekli yeniliklerle birlikte daha da büyüyeceği açıktır.

Şekil 2. *LMCA ve RCA ile ortak kök varyasyonu*

Şekil 3. *LMCA'sız çift ostiumlu LAD-CxA çıkış paterni" yazabilirsek tamamdır. Teşekkürler*

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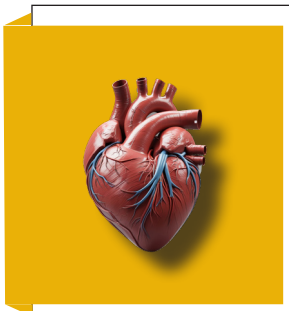

KALP VE DAMAR HASTALIKLARININ TANISINDA MANYETİK REZONANS GÖRÜNTÜLEME

BÖLÜM
13

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MRG: Manyetik rezonans görüntüleme
MI: Myocardial infarction / Miyokard enfarktüsü MPA: Miyokardiyal Perfüzyon Akımı
MVO: Mikrovasküler obstrüksiyonun
NDLVC: Non-dilated Left Ventricular Cardiomyopathy / Non-Dilate Sol Ventriküler Kardiyomiyopati
NSF: Nefrojenik sistemik fibrozis
PD: Proton density / Proton yoğunluğu
RCM: Restrictive Cardiomyopathy / Restriktif Kardiyomiyopati RF: Radyo frekans
RV: Right ventricle / Sağ ventrikülü
RVOT: Right ventricular outflow tract / Sağ ventrikül çıkış yolunu SE: Spin Eko
sRV: Sistemik sağ ventrikülün SSFP: Steady-state free precession
TEE: Transözofageal ekokardiyografi
TGA: Transposition of Great Arteries / Büyük arterlerin transpozisyonu TOF: Tetralogy of Fallot / Fallot tetralojisi
TTE: Transtorasik ekokardiyografi V: Velosite / Hız
YZ: Yapay zekâ

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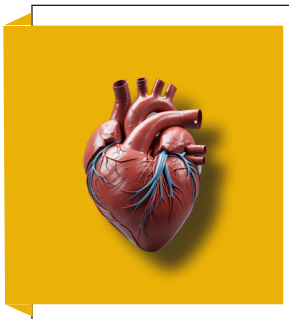

KARDİYOPULMONER RESÜSİTASYON

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14

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ve geri döndürülebilir nedenlerin dışlanmasına rağmen yanıt alınamaması durumunda tedavinin geri çekilmesi konusunda ekip ve aile ile görüşülmesi uygun olacaktır.

ÖZEL DURUMLARDA KARDİAK ARREST (AMELİYATHANE, KALP CERRAHİSİ, KATETERİZASYON LABORATUVARI)

ERC 2025 kılavuzunda ameliyathanede cerrahi sırasında müdahalelere rağmen hastanın sistolik basıncı 50mmHg'nın altına düşerse ve ETCO2 de keskin bir düşüş eşlik ederse hemen göğüs kompresyonlarına başlanması, cerrahi tarafın bilgilendirilmesi ve POCUS ile geri döndürülebilinir nedenleri tayin edilmesi önerilmektedir. KPR' ye cevap alınamıyorsa erken E-CPR'ın düşünülmesi gerektiğide belirtilmektedir.

İnvaziv arter monitörizasyonu mevcut olan hastalarda yeterli koroner perfüzyon basıncı oluşturabilmek için kompresyonların en az diastolik kan basıncı 30mmHg ve ETCO2 değerinin en az 25mmHg olacak şekilde fizyolojik KPR anlayışı benimsenmektedir.

Bu esnada 50-100mcgr adrenalin titre edilerek uygulanması önerilmektedir, diastolik kan basıncının belli değere getiren dozların over doz ile ilişkili istenmeyen durumların önüne geçebileceği belirtilmektedir.

Kalp cerrahisi sonrası kardiak arrest vakalarında yoğun bakım personellerinin resüsitasyon teknik becerileri ve ileri yaşam teknikleri açısından yeterli donanımda olmaları önem arz etmektedir. Kardiak arrest klinik bulgular ve nabızsız basınç dalga formları ile doğrulanırken, ekokardiyografi ile neden (tamponand) saptanmaya çalışılmalıdır.

VF/VT saptanması durumunda 3 adede kadar ardışık defibrilasyon uygulanmalı, asistoli/ciddi bradikardi varsa erken pacing (epikardial/ transkutanöz) düşünülmelidir. Nabısız elektiriksel aktivite mevcut ise geri döndürülebilinir nedenler düzeltilmeli. Eğer pace ritmi varsa, VF' yi dışlamak için pace kapatılmalıdır. Spontan dolaşım sağlanamazsa ve yeterli ekstrenal kompresyona rağmen sistolik kan basıncı >60 mmHg'nın üstüne çıkarılamazsa erken resternotomi gerçekleştirilmelidir(42). Resternotomi postoperatif 10.güne kadar ressüsitasyonun bir parçası kabul edilmelidir. Kardiak cerrahi sonrası ilk 10 günde şoklanabilir ritim varsa 3 defibrilasyon denenebilinir, 5 dk içinde yanıt alınamazsa resternotomi düşünülmelidir. E-KPR veya dolaşım destek cihazlarıda gerekli durumlarda uygulanmalıdır (44).

Kateterizasyon laboratuvarında gelişen hemodinamik instabilite veya komplikasyon şüphesi durumunda acil ekokardiyografi düşünülmelidir. Perkütan koroner girişim, septal alkol ablasyonu ve tavr da AV blok gelişebilir, göğüs ağrısı, hemodinamik instabilite ve EKG'de ST yükselmesi stent trombozunu veya TAVR'de koroner ostium oklüzyonunu akla getirmelidir. Defibrilasyon pedleri kompleks PKG ve yüksek riskli hastalarda takılmalıdır. Radyasyon varlığı nedeniyle kurtarıcı personelin zararlı X ışınlarından korumak amacıyla kurtarıcı girişimler mekanik KPR cihazı altında da uygulanabilinir (45). Kardiak arrest durumunda kalp cerrahisi geçiren hastalarda da uygulanan modifiye yetişkin yaşam desteği bu hastalara da uyarlanır.

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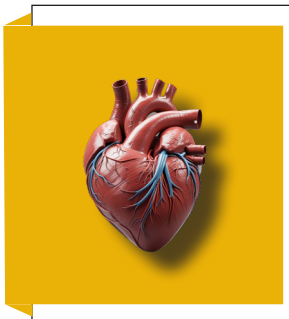

KALP CERRAHİSİ SONRASI YOĞUN BAKIM İZLEMİ

BÖLÜM
15

Seden KOCABAŞ [1]
Fatma AŞKAR [2]

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tışdan 5 gün sonra başlayan geç başlangıçlı VİP, daha sıklıkla çoklu ilaçlara rezistans gösteren mikroorganizmalar ile ilişkilidir (139).

Antibiyotik seçiminde, cerrahi alan infeksiyonlarının çoğundan gram pozitif mikroorganizmaların sorumlu olduğu göz önüne alınmalıdır. Sefalosporinler içerisinde gram pozitif aktivitesi daha sonraki jenerasyonlara oranla daha yüksek olan ve daha uygun fiyatlı sefazolin tercih edilebilir. Postoperatif VİP ve buna bağlı mortalitenin azaltılması için ikinci ve üçüncü kuşak sefalosporinler de önerilmiştir. Metisiline rezistan S.aureus (MRSA) insidansının yüksek olduğu hasta popülasyonları için vankomisin daha uygun bir seçim olabilir. Antibiyotikler, cilt insizyonu anında pik doku düzeylerine ulaşacak şekilde uygulanmalıdır. Antibiyotik profilaksisine, ilaç rezistansı olan mikroorganizma kolonizasyonunun artma riski nedeniyle 48 saatin ötesinde devam edilmesi önerilmez (139).

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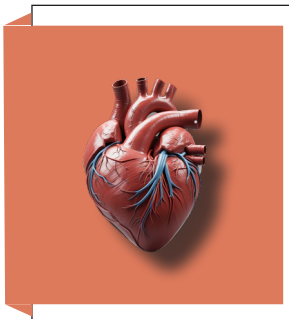

TRİKÜSPİT KAPAK HASTALİĞİ VE CERRAHİSİ

BÖLÜM
16

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lukta belirgin yapışıklıkları olmayan hastalar için, 4. interkostal aralıkta sağ minitorakotomi, endoskopi destekli veya tamamen endoskopik cerrahi uygun hastalarda tercih edilebilir. Asendan aortaya klemp konulmadan atan kalp de triküspit kapak cerrahisi uygulanabilir.

Kapakçıklar çok şiddetli deforme olmuş ise kapak eksize edilir ve replasman gerekir. Kapak eksize edilmeye karar verildiğinde kapakçık rimi bırakılmalıdır. Özellikle ileti sisteminin yaralanma riskini azaltmak için septal kapakçıkta bu daha önemlidir. Triküspit kapak replasmanında en büyük problem kalıcı tam blok riskidir. Triküspit kapak replasmanı için operatif mortalite %13 ve 1,5ve 10 yıllık survey sırasıyla %82, %76 ve %50'dir.(33) Postoperatif kalıcı tam blok riski %2-7 arasında değişir, %45 gibi oran verenlerde vardır.(34-36)

Triküspit pozisyonda mekanik kapak konulması önemli oranda kapak trombozu riski taşır. Bileaflet kapaklar düşük profilli olması ve hemodinamik özellikleri nedeniyle triküspit pozisyonda diğer kapaklara göre avantajlıdır.(37) Mekanik prostetik kapaklarda tromboz riski %4-30 arasındadır.(34,35,38) Prostetik mitral kapak trombozunun aksine triküspit kapak trombozu daha sinsidir. Reoperasyon daha düşük mortalite ile gerçekleştirilebilir.(34) Mekanik kapak bulunan hastalar ömür boyu antikoagülan ilaç kullanmak zorundadırlar. Bioprotezlerde daha düşük tromboz riski vardır. Genç hastalarda hızlı kalsifikasyon nedeniyle mekanik protezleri tercih etmek gerekir.(39,40) Çocukta triküspit pozisyonda konulan biyolojik kapakta kalsifikasyon riski mitral veya aortik pozisyonda konulanlara göre daha düşük orandadır.(41) Kaplan ve ark, biyoprotez ve mekanik kapak ile replasman yapılan hasta gruplarının karşılaştırmasında, her iki grup arasında erken mortalite, re-replasman ve orta dönem mortalite açısından istatistiksel olarak fark olmadığını belirtmişlerdir. Ancak hemodinamik karekteristikler ve dayanıklılık bakımından düşük profilli modern bileaflet mekanik kapakların kullanılmasını daha çok tavsiye etmişlerdir.(42) 8396 triküspit kapak replasmanı içeren 37 serinin meta analizinde; (3796 mekanik, 4520 biyoprotez) uzun vadeli sağ kalım ve yeniden ameliyat oranları bakımından iki kapak tipi arasında istatistiksel olarak anlamlı bir fark gözlenmedi, mekanik kapaklar trombotik olaylar açısından önemli ölçüde altı kat daha yüksek risk bulundu. .(43)

Aktif veya kronik infektif endokardite bağlı triküspit kapakta nekroz alanları olan hastalarda kapaktaki bu nekrotik bölgeler eksize edilir ve perikardiyal yama ile rekonstrüksiyon yapılır.(44,45) Erken veya geç enfeksiyon nüksünden sakınmak için ilaç bağımlılarında enfekte kapakçıkların eksize edilmesi önerilmektedir. Endokardit düzeldikten ve ilaç bağımlılığı rehabilite edildikten sonra sekonder kapak replasmanı uygulanabilir.(46-47) Fakat bu tartışmalıdır. Bazı hastalar akut masif triküspit yetmezliğini tolere edemezler. Stentsiz homogreft kapak veya bioprotez valvektomiye alternatif olarak primer implante edilebilir.(48,49)

Triküspit anuloplasti erken ve geç sonuçlarına göre replasmandan daha iyidir. Replasmandan mümkün olduğunca sakınılmalıdır.(50) Triküspit protezlerin tromboz riski daha yüksek ve uzun dönem fonksiyonel sonuçları mitral ve aort kapaklara göre daha kötüdür.

Operasyon riski yüksek hastalarda açık kapak ameliyatlarına alternatif olarak perkütan aort kapak replasmanı(TAVİ) kılavuzlarda klinik olarak yaygın uygulama alanına bulmuştur. Son yıllarda transkateter triküspit kapak-içinde-kapak replasmanı (TTVR), dejenerasyona uğramış triküspit biyoprotezleri ve triküspit anüler ringi olan çok yüksek cerrahi riskli hastalarda cazip bir terapötik seçenektir. TTVR uygulanabilir, güvenli ve yaşam kalitesini iyileştirme yeteneğine sahip olduğu gösterilmiştir.(51,52)

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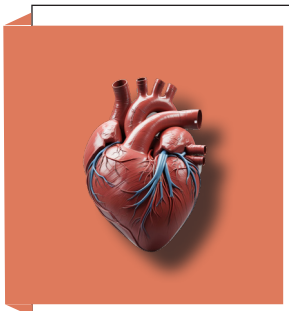

DEJENERATİF MİTRAL KAPAK HASTALIKLARI

BÖLÜM
17

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AltaValve™ (4C Medical Technologies): Atriyal yerleşimli özgün bir tasarıma sahiptir.(392-397) Subvalvüler aparatla temas etmeden sadece sol atriyum içinden yerleştirilir. Bu sayede sol ventrikül çıkım yolu obstrüksiyonu riski azaltılır.

TMVR sistemlerinin gelişimiyle birlikte hasta seçimi, anüler ve ventriküler anatomik uygunluk, sol ventrikül çıkım yolu obstrüksiyonu (LVOT-O) riski gibi parametrelerin multidisipliner ekiplerce dikkatli değerlendirilmesi büyük önem taşır.

Avrupa, Amerika Birleşik Devletleri ve Kanada'daki 12 merkezde, 2015-2018 yılları arasında TMVR için taranan ardışık hastalarda yürütülen uluslararası çok merkezli çalışmada hastaların yaklaşık üçte ikisi, TMVR için anatomik olarak uygun bulunmadıkları gerekçesiyle taramayı geçememiştir.(398) Bu çalışmanın bulguları önemli klinik sonuçlar doğurmakta; karşılanmamış bir klinik ihtiyaca işaret etmekte ve gelecekteki TMVR cihazlarının tasarımında yenilik için hedef bir alan sunmaktadır.(398)

TMVR, günümüzde seçilmiş hasta gruplarında umut vadeden sonuçlar sunsa da, uzun dönem klinik sonuçlara ilişkin veriler kısıtlıdır (91) ve bu alandaki teknolojilerin daha da rafine edilmesine ihtiyaç duyulmaktadır.

3D Baskı ve Yapay Zekâ Destekli Cerrahi Planlama

Dejeneratif mitral kapak hastalıklarının cerrahi onarımında hastaya özel stratejilerin geliştirilmesi, anatomik varyasyonların artan farkındalığı ve kompleks vakalarda preoperatif öngörü ihtiyacını gündeme getirmiştir. Bu bağlamda, 3 boyutlu (3D) baskı teknolojileri ve yapay zekâ (YZ) destekli modelleme sistemleri, cerrahi planlamada önemli katkılar sunmaktadır.

Konjenital kalp hastalıkları,(399) koroner arter hastalığı ve cerrahi ya da kateter temelli yapısal kalp hastalıklarında uygulama alanı bulan 3 boyutlu baskı, kardiyovasküler girişimlerin görüntülenmesi, planlanması ve uygulanma biçimini dönüştüren yeni bir araç olarak öne çıkmaktadır. (400-402) Ekokardiyografi, kardiyak BT ve manyetik rezonans görüntüleme (KMR) gibi görüntüleme yöntemlerinden elde edilen veriler, dijital modellere dönüştürülerek 3D yazıcılarla fiziksel kalp modelleri üretilebilir. Bu modeller, cerrahın spesifik patolojiyi üç boyutlu olarak görmesine olanak tanır (örneğin prolapsus bölgesi, anüler dilatasyon, kalsifikasyon). Özellikle kompleks mitral onarımlarda simülasyon yapılmasına ve operasyon öncesi strateji belirlenmesine yardımcı olur. Eğitim ve hasta bilgilendirme süreçlerinde görsel iletişim aracı olarak kullanılabilir.(400)

Yapay zekâ algoritmaları, dijital oskültasyon,(403) görüntüleme verilerinden otomatik mitral anülus ölçümleri, liflet hareket analizleri, regürjitan volüm tahminleri ve cerrahi sonuç projeksiyonları gibi çıktılar üretebilmektedir. (404, 405) Özellikle makine öğrenimi temelli modeller mitral kapağın dinamik hareketlerini simüle ederek koaptasyon hatlarını analiz edebilir, postoperatif rezidüel regürjitasyon veya LVOT obstrüksiyonu riskini öngörebilir, TMVR adaylarında cihaz seçimi ve uygunluk değerlendirmesini hızlandırabilir.(404, 405)

Bu teknolojiler sayesinde operasyon öncesi hazırlık süresi kısalmakta, komplikasyon oranları azaltılabilmektedir. Cerrahi sonuçların daha öngörülebilir ve standardize edilmesi mümkün olabilmektedir. İlerleyen dönemde robotik cerrahi sistemleriyle bütünleşmiş çalışabilecek planlama sistemleri geliştirilmektedir.

Sonuç olarak, 3D baskı ve yapay zekâ destekli planlama, DMKH'ye yönelik cerrahi yaklaşımda kişiye özel, öngörülebilir ve daha güvenli bir dönemi başlatmaktadır. Bu teknolojilerin yaygınlaşması hem onarım oranlarının artırılmasına hem de

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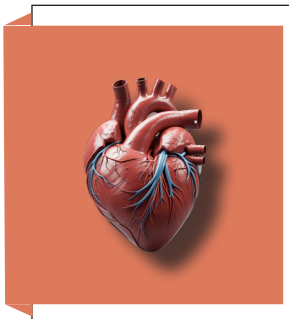

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18

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Yapay zekâ destekli görüntü analizi ile ekokardiyografik parametrelerin otomatik ölçümü, kapak geometrisinin daha hassas değerlendirilmesi ve hasta seçiminde kişiselleştirilmiş risk tahminleri mümkün hale gelmektedir. Biyobelirteçler (özellikle NT-proBNP ve yüksek duyarlılıklı troponin), hastalığın progresyonunu ve tedaviye yanıtı öngörmede giderek daha fazla kullanılacaktır. 4B akım KMR teknikleri, MY jetlerinin dinamik karakterini ve ventrikülo-atrial etkileşimi üç boyutlu hemodinamik düzeyde ortaya koyarak yeni bir bakış açısı sunmaktadır (425, 426).

İMY'nin gelecekteki araştırma alanlarından biri de translasyonel düzeyde kapak biyolojisinin daha iyi anlaşılmasıdır. Yaprakçık dokusunda gözlenen adaptif büyüme ile mal-adaptif fibrotik yeniden şekillenme arasındaki dengenin moleküler mekanizmaları, özellikle TGF-β aracılı fibrozis yolakları, inflamatuvar hücre infiltrasyonu ve ekstraselüler matriks yeniden yapılanması üzerine yoğunlaşmaktadır. Ayrıca genetik predispozisyon ve kapak hücre biyolojisini etkileyen epigenetik mekanizmaların aydınlatılması, gelecekte kişiselleştirilmiş tedavi stratejilerinin geliştirilmesine katkı sağlayacaktır.

Cerrahi alanda ise klasik restriktif ring annuloplasti ve kapak replasmanı dışında, chordal-sparing teknikler ve papiller kas reposition yöntemleri ön plana çıkmaktadır. Bu girişimsel yenilikler, ventrikül geometresinin yeniden düzenlenmesi ve koaptasyon yüzeyinin optimize edilmesi yoluyla İMY'nin tekrarlama riskini azaltmayı amaçlamaktadır. Özellikle papiller kasların yeniden pozisyonlanmasına yönelik cerrahi ve kateter bazlı tekniklerin, gelecekte hem izole hem de kombine yaklaşımlarda daha geniş yer bulması beklenmektedir. Robotik cerrahideki ilerlemeler ve anatomik varyasyonlara uyum sağlayabilen ve adaptif mekanizmalarla tasarlanmış yeni nesil transkateter mitral protezler umut vericidir. Bu teknolojik yenilikler, İMY'nin hem tanısında hem de tedavisinde bireyselleştirilmiş stratejilere olanak sağlayarak hasta sonuçlarını iyileştirmeyi hedeflemektedir.

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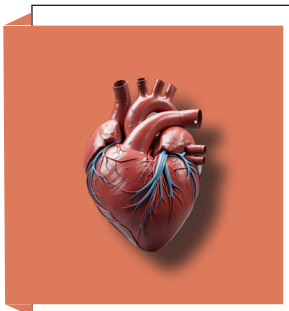

AKUT ROMATİZMAL ATEŞ VE ROMATİZMAL MİTRAL KAPAK HASTALIKLARI

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19

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KAYNAKLAR

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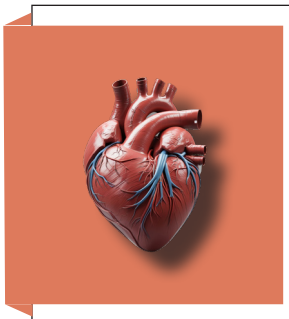

MİTRAL VE TRİKÜSPİT KAPAK HASTALIKLARINDA PERKÜTAN TEDAVİ

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20

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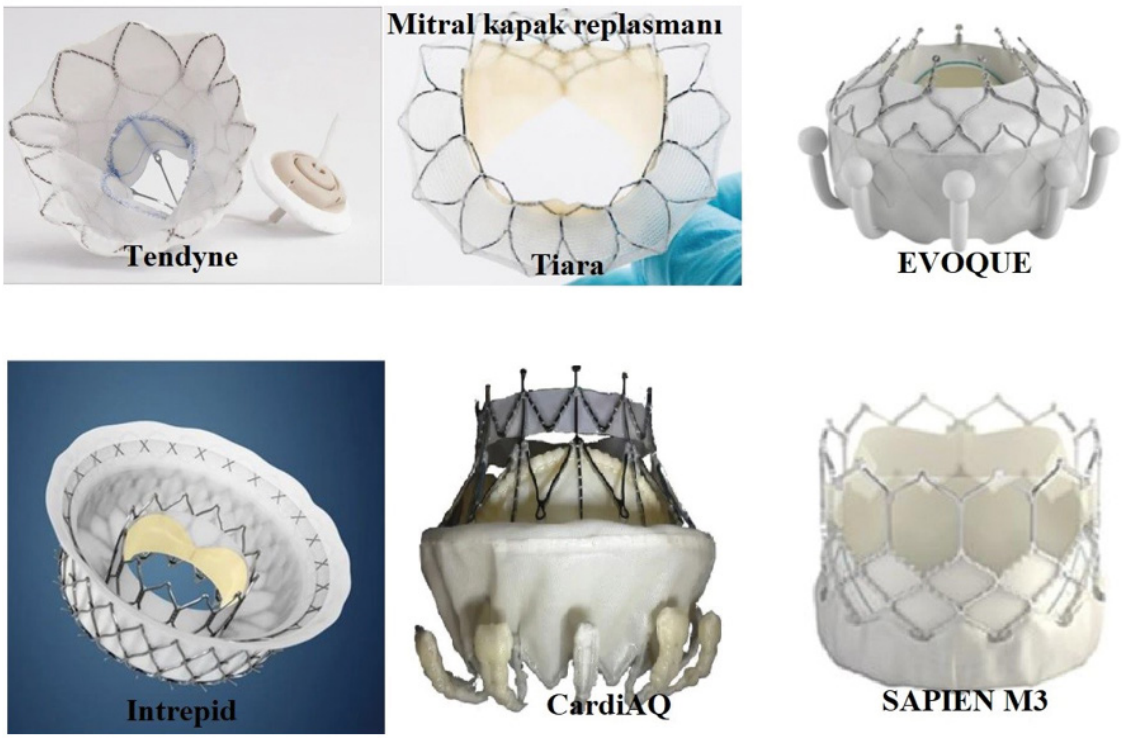

Şekil 6. *Mitral kapak replasmanı*

PERKÜTAN TRİKÜSPİT KAPAK GİRİŞİMLERİ

Triküspit yetmezliği (TY) nadiren birincil kapak patolojisine bağlı olup sıklıkla sol taraf kapak hastalığına ikincil olarak görülen, sık karşılaşılan kapak hastalıklarının başında gelmektedir. Patofizyolojisinde anüler halkanın dilatasyonu ve koaptasyon kusuru vardır.(23) Triküspit yetmezliği asemptomatik olabileceği gibi sağ kalp yetmezliği kliniği ile birlikte görülebilir. İzole triküspit cerrahisi nadiren yapılmakta ve klinik sonuçları üzerine etkisi belirsizliğini korumaktadır. Bu yüzden minimal invaziv, komplikasyon oranı düşük transkateter tedavi seçeneklerinin geliştirilmesine ihtiyaç vardır. Transkateter uçtan uca triküspit kapak onarımı (Mirtaklip ve PASCAL) ve transkateter direkt anüloplasti (Cardioband) ile triküspit kapak onarımı perkütan yolla yapılabilmektedir.

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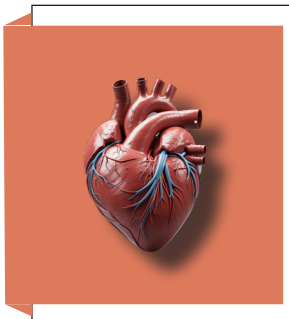

KARDİYAK CERRAHİDE MİTRAL KAPAK ONARIMI

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21

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hem de güvenliği artıracak; daha geniş bir hasta popülasyonuna üstün sonuçlarla tedavi imkânı sunacaktır.

Kısaltmalar

MY: Mitral yetmezlik; AF: Atrial fibrilasyon; PHT: Pulmoner hipertansiyon; MVP: Mitral valv prolapsusu; MD: Mitral darlık; MKA: Mitral kapak alanı; SVSSÇ: Sol ventrikül sistol sonu çapı; EF: Ejeksiyon fraksiyonu; PMK: Perkütan mitral komissürotomi; KABG: Koroner arter bypass greftleme; TÖE: Transözofageal ekokardiyografi; MRG: Manyetik rezonans görüntüleme; KPB: Kardiyopulmoner baypas; SAM: Sistolik anterior hareketlenme; PTFE: Politetrafloroetilen; INR: Uluslararası normalleştirilmiş oran; SVÇY: Sol ventrikül çıkım yolu; ERACS: Early Recovery After Cardiac Surgery; NYHA: New York Heart Association

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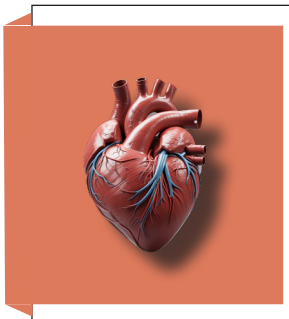

TRİKÜSPİT KAPAK HASTALIKLARI VE CERRAHİ TEDAVİ YÖNTEMLERİ

BÖLÜM
22

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kompleks anatomisi, önemli yapısal komşulukları nedeniyle rutin kullanımda çekinceler mevcuttur.

Transkateter tedaviler kabaca 2 grubu ayrılabilir.

1- Transkateter TV replasmanı
2- Transkateter TV koaptasyon ya da annuloplasti cihazları ile tamir

Geniş koaptasyon bozukluklarında (>8 mm), ciddi kordal tethering ve kalsifikasyon varlığında, Ebstein anomalisi ya da pacemaker leadleri varlığında transkateter tamir yerine replasman düşünülmelidir. Transkateter TVR için pek çok kapak uyumlu değildir. Zorlu anatomisi nedeniyle kompleks bir girişimsel işlemdir. Ortotopik ya da heterotopik kapaklar kullanılabilir. TTVR uygunsuzluğu durumlarında kaval valv implantasyonları (CAVI) da semptomatik tedavide değerlendirilebilir.

Transkateter kaoptasyon cihazları mitral kapak tecrübelerinden uyarlanan ve MitraClip' in triküspit kapak için geliştirilmiş versiyonu olan ve cerrahi Clover tekniği benzeri uç-uç tamir sağlayan TriClip cihazıdır. Transfemoral ya da transjuguler yoldan uygulanabilmektedirler.

Annuloplasti cihazları da benzer femoral ven ya da juguler ven aracılığı ile yerleştirilen ve cerrahi Kay annuloplasti benzeri annulus plikasyonu sağlayan cihazlardır (23).

Biyolojik kapak dejenerasyonları ya da ring annuloplasti sonrası rekürren yetmezlik ve reoperasyon gereken yüksek riskli hasta gruplarında transkateter triküspit valve-in-valve ya da valve-in-ring implantasyonlar fayda sağlayabilmektedir ancak rutin kullanımları için daha çok tecrübe ve çalışmaya ihtiyaç vardır.

İlerleyen teknoloji ile bu alanda pek çok cihaz piyasa sürülmüş olmakla birlikte uzun dönem sonuçları hakkında bilgi yetersizliği, prosedürel zorlukları nedeniyle kullanımları günümüzde cerrahi riski yüksek hastalar ile sınırlı kalmaktadır. Aynı zamanda sağladığı faydanın düşük, ekonomik yükünün ise fazla olması ulusal sağlık politikalarında yer edinmesini zorlaştırmaktadır. İlerleyen zamanlarda yeni teknik ve cihazlar ve uygulama standardizasyonları sayesinde daha yaygın kullanım alanı bulma imkanı mevcut yöntemlerdir.

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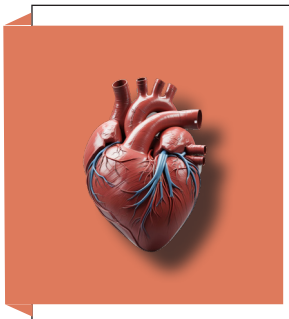

ERİŞKİN PERKÜTAN KAPAK GİRİŞİMLERİ

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23

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Teknoloji	Özellik	Klinik Etki
SAPIEN 3 Ultra	Düşük profil, sızdırmaz etek (4)	Paravalvüler kaçak azalması
Evolut PRO+	Yeniden konumlandırılabilir (4)	Biküspit kapaklarda etkinlik
Sentinel Cihazı	Serebral koruma (18)	İnme riskinde %30-50 azalma
AI Destekli BT	Otomatik anulus ölçümü (19)	Prosedür doğruluğunda artış

GELECEK PERSPEKTİFLERİ

TAVR'nin endikasyonları genişlemektedir:

- Asemptomatik Aort Stenozu: EARLY TAVR çalışması, erken müdahalenin potansiyel faydalarını araştırmaktadır (21).
- Biküspit Aort Kapağı: Yeni kapak tasarımlarıyla artan başarı oranları (16).
- Kapak İçi Kapak (Valve-in-Valve): Biyoprotezik kapak dejenerasyonunda etkili bir seçenek (22). Minimal invaziv teknolojiler, robotik sistemler ve kişiselleştirilmiş kapak tasarımları, TAVR'nin geleceğini şekillendirecektir (20). Ayrıca, genç hastalarda kapak dayanıklılığı üzerine uzun dönem çalışmalar devam etmektedir (23).

SONUÇ

TAVR, aort stenozu tedavisinde devrim niteliğinde bir yöntem olarak, yüksek riskli hastalardan düşük riskli hastalara kadar geniş bir hasta grubunda standart tedavi haline gelmiştir (2,3). Teknolojik ilerlemeler, komplikasyon oranlarını azaltmış ve klinik sonuçları iyileştirmiştir (4). Multidisipliner kalp ekipleri ve güncel kılavuzlar, hasta seçimi ve prosedür başarısında kritik rol oynamaktadır (6). Gelecekteki çalışmalar, kapak dayanıklılığı, yeni endikasyonlar ve minimal invaziv teknolojilere odaklanacaktır (21,22). TAVR, kardiyovasküler tıpta yenilikçi bir çözüm olarak yerini sağlamlaştırmaya devam etmektedir.

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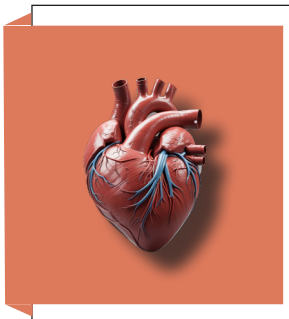

AORT KAPAK ONARIM ENDİKASYON VE TEKNİKLERİ

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24

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Tip A diseksiyon olgularında Florida Sleeve prosedürü, annulus ve sinotübüler bileşke stabilizasyonunu koroner ostium reimplantasyonu ve SV rezeksiyonu yapmaksızın sağlamayı hedefleyen bir kapak koruyucu yaklaşım olup, kökün fizyolojik mimarisine minimal müdahalede bulunması ve cerrahi süre avantajı sunması nedeniyle uygun diseksiyon vakalarında başarılı sonuçlar verebilmektedir. Cerrahi uygulamada benzer hazırlık aşamalarından sonra aort kökünün eksternal diseksiyonu yapılır ve koroner ostiumların konumu belirlenir; ardından subannuler düzeyde, genellikle üç-dört adet plejitli 2-0 prolen sütür içten dışa horizontal matris şeklinde geçilerek dışarıda bırakılır. Asendan aort grefti, aort kökünün etrafına konumlandırıldıktan sonra koroner arterlerin çıkış bölgeleri işaretlenir ve bu noktalar koter yardımıyla dikey yarıklar açılarak genişletilir; greft aynı pozisyonda köke yerleştirilerek koroner arteri engellemediği doğrulanır. Subannuler sütürler daha sonra greftten de geçirilip dışarıdan bağlanırken, aortun büzülmesini önlemek amacıyla annulusun içinde Hegar bujisi tutulur. Açılan yarıkların, koroner arterin alt kısmında kalan uç kısımları sütüre edilerek kök etrafında stabilize edici bir halka oluşturulur; koroner arterlerin sorunsuz şekilde korunduğundan emin olunduktan sonra greftin distal bölümü sinotübüler bileşke seviyesine göre uyarlanıp kesilir. Komissürler STJ'ye resüspanse edilir. STJ seviyesinde tüm katları birleştiren sağlam bir anastomoz halkası oluşturmak için; nativ aort, greft ve bir teflon şerit 3-0 prolen devamlı horizontal matris sütür tekniği ile birleştirilir. Sonrasında kapakçıkların koaptasyonu kontrol edilir ve gerekli düzeltmeler yapılır ve kök cerrahisi aşaması tamamlanır. Asendan aortun distal bölümü ise oluşturulan yeni sinotübüler bileşkeye ayrı bir greft anastomozuyla tamamlanarak cerrahi tamamlanır.

SONUÇ

Aort kapak tamiri, uygun hastalarda doğal kapağın korunması sayesinde protez kapağa kıyasla daha fizyolojik bir çözümdür ve yaşam kalitesine olumlu etki gösterir. Bu yöntem, özellikle genç ve antikoagülan tedavi riskinin yüksek olduğu hastalar için ideal bir seçenektir. Ancak, hasta seçimi, kapağın yapısal özelliklerinin ve patolojisinin iyi anlaşılması ve bunların bütüncül olarak ele alınması gerekmektedir. Cerrahın ve merkezin deneyimi büyük önem taşır. Literatürdeki veriler bu şartlar sağlandığında, kısa ve uzun vadeli iyi operatif sonuçlar elde edilebildiğini göstermektedir.

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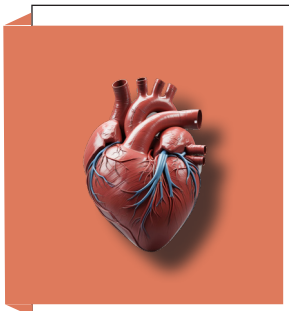

AORT DARLIĞI

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25

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Kalıcı Kalp Pili Gereksinimi

Aort kapak girişimi sonrası kalıcı pil ihtiyacı TAVI grubunda her zaman daha fazladır. Postoperatif ilk 30 gün içerisinde kalıcı pil gereksinimi SAVR hastalarında %2 altında seyrederken TAVI grubunda bu oran %12'lere kadar çıkmaktadır (64).

Yeniden Aort Kapak Girişim Gerekliliği

Stentsiz biyoprotezlerde strüktürel dejenerasyon stentli tiplere nazaran daha azdır. Stentli biyoprotezlerde zamanla meydana gelen rüptür genellikle yaprakçık dejenerasyonu ve kalsifikasyonu ile birliktedir. Kalsifikasyon yeni bir aort darlığına da yol açabilir. Literatürde aynı veya farklı biyoprotez kapaklarla ilgili farklı çalışmalarda yapısal kapak disfonksiyonu, mortalite ve yeniden girişim oranları değişkenlik gösterse de genel olarak 10 yılda %90 üzerinde bir girişimden bağımsızlık oranı mevcut olduğu görülmektedir. 10 yıldan sonra bu oran yıllar içinde azalmaktadır. Biyolojik protez kullanılarak yapılan SAVR / TAVI karşılaştırmasında 10 yıllık sonuçlara bakılınca cerrahi kolda ciddi yapısal bozulmanın çok daha yüksek olduğu (%10 / %1.5) görülmektedir (59).

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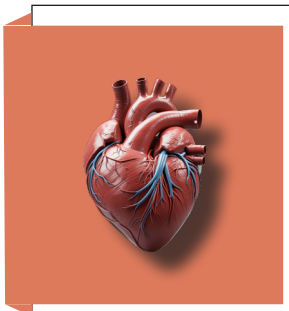

AORT YETMEZLİĞİ

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lanımına bağlı olarak yaprakçık delinmesi veya ring ayrışmasına bağlı erken başarısızlıklar bildirilmiştir (36). Ülkemizde ilk defa kliniğimizde 5 hastaya subannuler aortik rijid ring uygulanmış olup, perioperatif transözefageal ekokardiyografi kontrollerinde kapaklar kompetan bulunmuştur. Özellikle David aort kök girişimlerinde annuler dilatasyonu önlemek, sol ventrikül mekanik destek cihazı uygulamalarında aort yetmezliğini gidermek amacı ile tercih edilmelidir.

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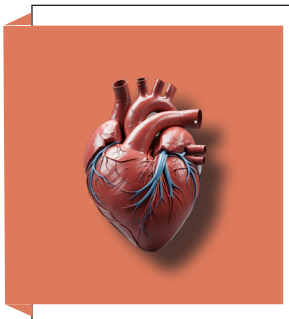

HİPERTROFİK KARDİYOMİYOPATİ

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septal hipertrofili SCÇY obstrüksiyonunun oluşumuna katkıda bulunduğu birtakım durumlar vardır. Bu olgularda mitral kapak ön yaprakçığı, sistol esnasında belirgin olarak septuma doğru yaklaşırken sol ventrikül çıkım yolunu daraltır, ancak aynı zamanda mitral kapakta belirgin inkompetans meydana gelir. Böyle bir durumda septal miyektomi ile birlikte mitral kapak replasmanı daha doğru bir yaklaşım olacaktır. Mitral kapak ön yaprakçığının uzun olduğu durumlarda yaprakçığın uzun ekseni boyuncu yapılacak bir plikasyon da seçenekler arasındadır. Mitral kapak müdahale gereği nadir olmakla birlikte (%4), preoperatif ciddi mitral yetmezliği olanlarda bu oran daha yüksektir (74). Özellikle mitral kapakta yapısal bozukluklar da varsa girişim kaçınılmazdır. Bizim serimizde de hastaların 2'sine (%6.3) mitral kapak onarımı ve 6'sına (%18.8) mitral kapak replasmanı uygulandı (66).

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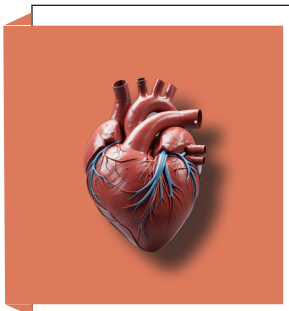

HOMOGREFT, OTOGREFT VE HETEROGREFTLER

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28

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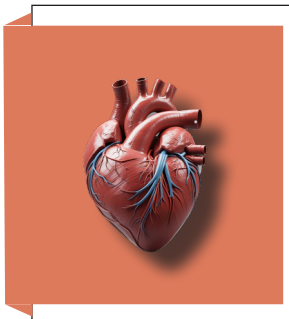

KALP KAPAK PROTEZLERİ

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29

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Sıklıkla pulmoner kapağın çıkarılarak aort pozisyonuna yerleştirildiği prosedürlerde tercih edilen otogreftlerde çıkarılan kapağın yerine yerleştirilecek protez kapağın oluşturabileceği sorunlar ve Ross prosedürünün hem teknik zorlukları hem de uzun süresi, bu yöntemin önemli dezavantajları arasında yer almaktadır.

Rose prosedürü olarak bilinen, sıklıkla pulmoner kapağın çıkarılıp aort pozisyonuna yerleştirildiği otogreft uygulamalarında, çıkarılan kapağın yerine takılacak protez kapağın sebep olabileceği sorunlar ile Ross prosedürünün teknik zorlukları ve uzun operasyon süresi, bu yöntemin temel dezavantajları arasında yer almaktadır.

Homogreft kalp kapaklarının en yeni modellerinde bile, antijenite ve sonucunda greft yetmezliğine yol açan immünolojik konakçı reaksiyonları, hala önemli bir sorun olarak varlığını sürdürmektedir. Bu ve benzeri problemleri çözmek amacıyla, tüm protez kalp kapakları için iyileştirme çalışmaları aktif bir şekilde devam etmektedir. Diğer taraftan doku mühendisliği alanında, kemik iliği, deri ve mesane rekonstrüksiyonu üzerine yapılan çalışmalar, birim hücrelerden yararlanarak damar greftleri ve kalp kapağı lifletlerinin üretilmesine yönelik araştırmaların başlamasına zemin hazırlamıştır (64,65). Biyoprotez kalp kapakları, büyüme, onarım ve adaptasyon kapasitesinden yoksun olmaları nedeniyle önemli sınırlamalara sahiptir. Bu eksiklikler, greftlerin kalsifikasyon ve dejenerasyona neden olan bağışıklık tepkilerini tetiklemesiyle daha da belirgin hale gelmektedir. Bu bağlamda, kalp kapak dokusu mühendisliği, immünolojik ve inflamatuar reaksiyonlardan arındırılmış, kendi kendini onarabilen ve uzun süre dayanıklı canlı kapakların geliştirilmesini amaçlamaktadır.

Doku mühendisliği yaklaşımları, yeni doku üretiminde üç ana süreci içermektedir: 3D biyomateryal iskele üretimi, uygun hücre kaynağının belirlenmesi ve implantasyondan önceki gelişim koşullarının optimize edilmesi. Hücreler, in vitro veya in vivo ortamda bu iskelelere yerleştirilerek doku oluşumu desteklenmektedir . Özellikle, hücresizleştirilmiş doku matrisleri, biyolojik olarak çözünebilir sentetik polimerler, hibrit doku mühendisliği stratejileri ve 3D baskı gibi teknolojiler bu süreçte yoğun şekilde kullanılmaktadır (66). Ancak mevcut uygulamalarda kalsifikasyon, iskelenin degradasyon oranı ve protezin mekanik dayanıklılığı gibi sorunlar halen çözülmeyi beklemektedir. Gelecekte, bio-hibrit iskeleler ve otolog hücrelerin kullanıldığı biyoreaktör çalışmaları, bu problemlerin üstesinden gelmek için önemli bir potansiyel sunmaktadır. Bununla birlikte, bu teknolojilerin uzun vadeli etkilerini değerlendirmek için daha kapsamlı ve süreklilik arz eden araştırmalara ihtiyaç duyulmaktadır (67,68).

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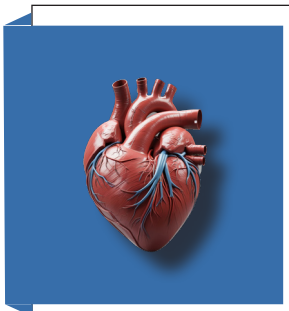

GİRİŞİMSEL KARDİYOLOJİ VE PERKÜTAN İNTRAKORONER GİRİŞİMLER

BÖLÜM
30

İpek YILDIZ [1]
Kemal Emrecan PARSOVA [2]
Refik ERDİM [3]
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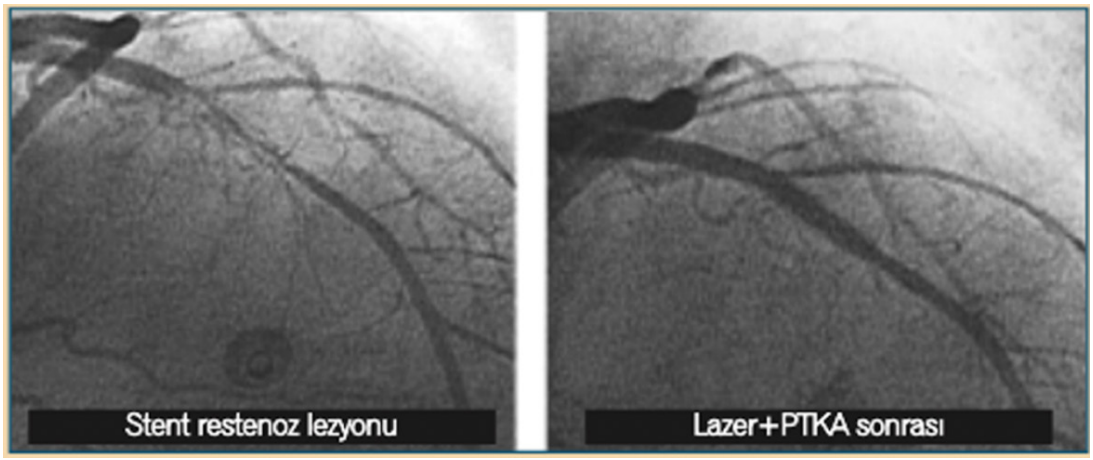
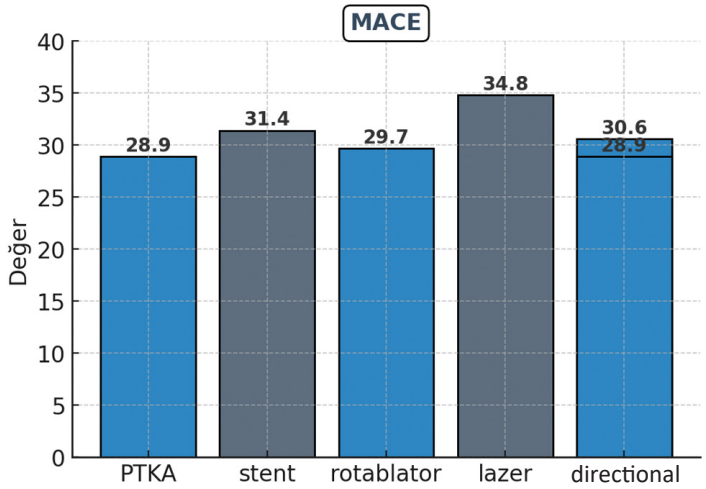


Resim 25. *Stent restenoz lezyonu. Lazer ve PTKA ile tedavi sonrası. (V. Aytekin arşivi)*



Grafik 3. *Stent içi restenozda çeşitli tedavi yöntemleri ve MACE*

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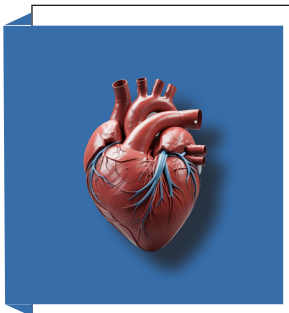

KORONER REVASKÜLARİZASYONDA CERRAHİ ENDİKASYONLAR

BÖLÜM
31

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4. Güncel çalışmalardan elde edilen kanıtlar, stabil iskemik kalp hastalığı, normal sol ventrikül ejeksiyon fraksiyonu ve anlamlı üç damar koroner arter hastalığı olan hastalarda revaskülarizasyonun yaşam süresini uzatmada medikal tedaviye olan üsütünlüğü eski kanıtları desteklemektedir. Bu hastalarda cerrahi revaskülarizasyon yaşam süresini uzatmak için uygun bir seçenek olabilir. Perkütan revaskülarizasyonun, yaşam süresini uzatmada cerrahiye olan üstünlüğü netleşmemiştir. Revaskülarizasyon kararları; koroner lezyonlarının yapısı, eşlik den hastalıkların varlığı ve tedavinin teknik uygulanabilirliği göz önüne alınarak, hasta özelinde kalp ekibi tarafından verilmelidir.
5. Sol ön inen koroner arterde önemli stenozun yanında sağ veya sirkümfleks arterde önemli oranda darlığı olan hastlarda, ikinci greft olarak radial arter tercih edilebilir. Avantajları arasında safen grefte göre üstün açıklık oranı, greft çıkarılmasına bağlı cerrahi komplikasyonların düşüklüğü ve yaşam süresini uzatmaya olumlu etkisi yer alır.
6. Akut koroner sendromlu veya stabil iskemik kalp hastalığı olan hastalarda, perkütan girişim için; radial arter, femoral artere tercih edilmelidir. Böylece vasküler komplikasyon ve kanama riski azalacaktır. Bu yaklaşım, akut koroner sendromlu hastalarda, mortaliteyi olumlu etkileyen bir uygulama olur.
7. Stabil iskemik kalp hastalığı olan hastalarda perkütan revaskülarizasyondan sonra, kanama riski göz önüne alınarak, ikili antiplatelet tedavi kısa süreli uygulanmalıdır. İskemi riski riski ortadan kalktıktan sonra, uygun hastalarta, aspirin kesilerek, P2Y12 reseptör inhibitörü (klopidogrel, prasugrel, tikagrelor, tiklopidin) tekli antiplatelet tedaviye geçilebilir. Bu süre yaklaşık 1-3 ay arasında değişeblir.
8. ST segment yüksekliği ile seyreden akut MI'lı hastada temel amaç iskemiye neden olan koroner arterdeki darlığın giderilmesidir. Bunun için primer perkütan revaskülarizasyon önerilir. Bunun yanısıra, hastada akut iskemiye neden olan damar dışında anlamlı darlığı olan ikinci bir koroner arter darlığı varsa, hastanede yatarken veya taburcu edildikten sonra, bu darlık için de perkütan revzakülarizasyon yapılabilir. İskemi nedeni olmayan koroner artere aynı seansta perkütan girişim yapılması, hastanın böbrek fonksiyonlarının normal olmasına bağlıdır. Ancak hasta kardiyojenik şok tablosu içindeyse iskemi nedeni olmayan koroner artere girişim düşünülmemelidir.
9. Diyabet ve çok damar koroner arter hastalığı olan hastalarda revaskülarizasyon kararları kalp takımı tarafından alınmalıdır. Üç damar hastalığı olan diyabetli hastalarda öncelikle cerrahi revaskülarizasyona düşünülmelidir. Eşlik eden hastalıklar, hastanın yaşı ve fizik kondisyonu nedeniyle, hasta cerrahi için uygun aday değilse, perkütan koroner girişim düşünülebilir.
10. Koroner arter hastalığında cerrahi revaskülarizasyon kararı, hastanın cerrahi riski Society of Thoracic Surgeons skoruyla hesaplandıktan sonra verilmelidir. SYNTAX skor hesaplamasının tedavi kararlarındaki yeri, gözlemciler arası değişkenlik göstermesi ve uygulamada klinik değişkenlerin olmaması nedeniyle daha az değerlidir.(180)

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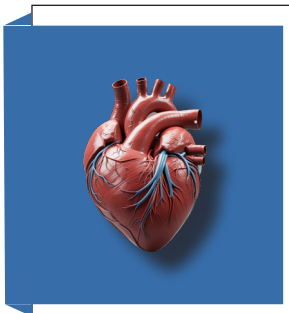

KORONER ARTER BYPASS CERRAHİSİ

BÖLÜM
32

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şekli olarak geçerliliğini sürdürmektedir. Koroner arter bypass cerrahisi perkütan işlemlere göre survi avantajına sahiptir. Koroner arter bypass cerrahisinde uygun hasta gruplarında arteryel greft kullanımının daha da yaygınlaşması bu cerrahinin etkisinin daha iyi gözlemlenmesi açısından önemlidir. Gelecek açısından baktığımızda preventif tedavinin önem kazanacağını görmekteyiz.

TECAB ve MICS –KABG , koroner cerrahisinde nisbeten yeni gelişen tekniklerdir. Uzun dönem sonuçları ile ilgili randomize çalışmalar henüz gerçekleştirilmemiştir. Standart koroner bypass cerrahisinin bu yeni teknikler karşısındaki en büyük avantajı ise uzun dönem sonuçlarıdır. Teknoloji hızla ilerlemekte ve tedavi protokolleri her geçen gün değişmektedir. Burada en önemli kriter ise etkinliği geniş vaka serilerinde kanıtlanmış yöntemlerin tedavi yöntemi olarak seçilmesi gerekliliğidir.

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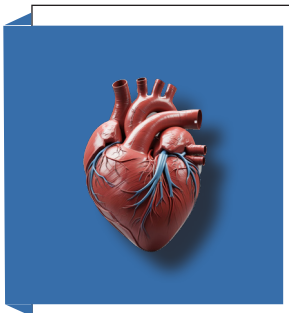

KORONER REOPERASYONLAR

BÖLÜM
33

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kal tedavinin ve girişimsel kardiyolojik işlemlerin yetemediği durumlarda bu reoperasyonlar kabul edilebilir bir risk ile yapılabilir ve hastanın yaşam kalitesini arttırır ve ömrünü uzatır.

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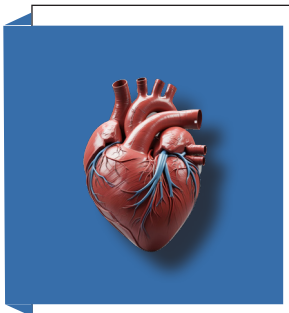

NON-ATEROSKLEROTİK KORONER ARTER HASTALIĞI

BÖLÜM
34

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rizması, poliarteritis nodosa, Takayasu arteriti, Marfan sendromu, sifiliz ve Reye sendromu ile de ilişkili olabilir. Anjina şikayeti olan hastalarda ektazi genellikle bir miktar koroner arter daralması ile birlikte görülür; ektazinin tek başına anjinaya neden olması olası değildir. Ektazi olan hastalarda mortalite oranı yüksektir; ektazik bölge içinde yavaş ve türbülanslı akım tromboza yatkınlığı artırır.

Koroner anevrizmalar, koroner arterlerin lokalize dilatasyonudur ve ateromatoz hastalık sonucunda ortaya çıkarlar (11). En sık neden Kawasaki sendromudur (12). Konjenital anomaliler, diseksiyon, enfeksiyon (sifiliz, bakteriyel ve mikotik enfeksiyonlar), poliarteritis nodosa, skleroderma, Ehler-Danlos sendromu, Takayasu arteriti, Marfan sendromu, metastatik tümör ve sistemik lupus eritematozus diğer olası nedenlerdir.

Miyokardiyal bridge genellikle kalp sistolü sırasında miyokard kaslarının LAD'yi (%0.7-5.5) sıkıştırması durumudur. Hipertrofik kardiyomiyopati hastalarında ani ölüm sebeplerinden biri de bu bridge'lerdir.

Kateter kaynaklı koroner vazospazm en sık sağ koroner arterin selektif kateterizasyonu sırasında görülür (13). Spazm şüphesi varsa, vazodilatör ajan uygulandıktan sonra görüntüleme tekrarlanmalıdır. Fakat spazm sonucu malign aritmiler gelişe bileceği unutulmamalıdır.

SONUÇ

Aterosklerotik kalp hastalığı ne kadar yaygın olsa da koroner anomaliler, konjenital ve edinilmiş non-aterosklerotik koroner patolojiler ayrıcı tanıda göz ardı edilmemelidir. Bunlar hasta nadir görülse de tedavi edilebilir. Bu makalede sunulan durumların farkında olmak ve bu durumların optimal radyolojik gösterimi, iyi hasta bakımı için olmazsa olmazdır.

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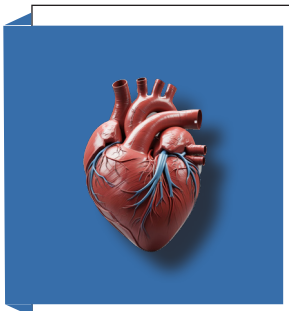

İNVAZİV KARDİYOLOJİK GİRİŞİMLER SONRASI ACİL KARDİYAK CERRAHİ

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35

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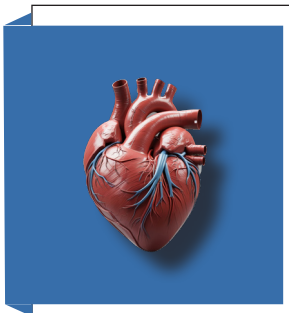

MİNİMAL İNVAZİV KALP CERRAHİSİ

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36

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dönemde yoğun bakım ve hastane kalış süresi, kan transfüzyon ihtiyacı, ağrı, solunum fonksiyonları, hasta memnuniyeti, hastane maliyeti açısından avantaj getirmesidir. Preoperatif dönemde hastanın genel durumu, anatomik yapısı, ek risk faktörleri ve patolojisi detaylı bir şekilde incelenerek hastaya yönelik belirlenecek cerrahi yöntem başarı oranlarını arttıracaktır.

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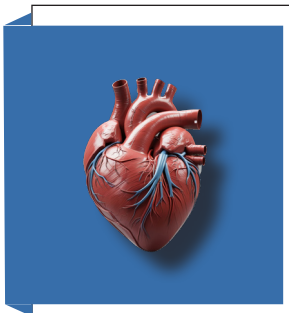

KALP CERRAHİSİNDE MİNİMAL İNVAZİV İNSİZYONLAR

BÖLÜM
37

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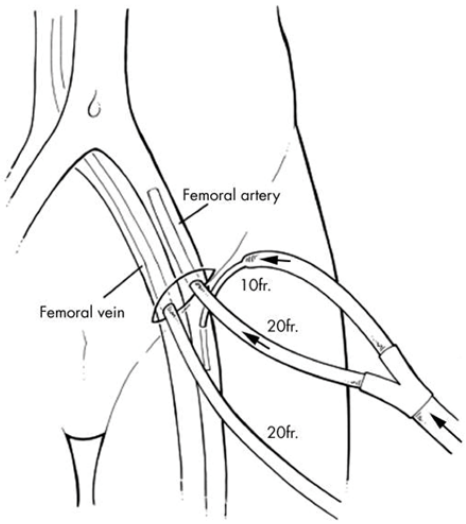
Tablo 2. Femoral kanülasyonun komplikasyonları (14)
Femoral arter diseksiyonu, Geç stenoz ya da tromboz, Kanama Lenfore ya da fistül, Kasık enfeksiyonu Serebral ya da koroner ateroemboli Bacak iskemisi (6 saati geçen olgularda)Venöz tromboz,



Şekil 12. *Alt ekstremitede distal perfüzyonu da sağlayan femoral arter ve ven tekniği (Resim, Cardiac surgery in the adult. Cohn and Edmunds, 2nd ed.'dan alınmıştır).(18)*

Sonuç olarak femoral kanülasyon minimal invaziv cerrahide kardiyopulmoner bypassı sağlamada önemli yaklaşımlardan biridir. Olası hayati komplikasyonlarından kaçınmak için preoperatif ve intraoperatif femoral arter ve venin kanülasyona uygunluğu açısından iyi değerlendirilmesi gerekir.

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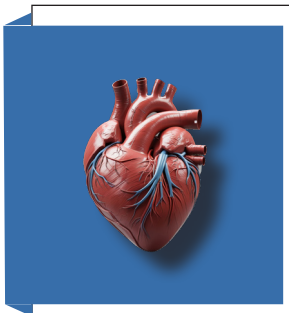

MİNİMAL İNVAZİV DİREKT KORONER ARTER BYPASS (MIDCAB) CERRAHİSİ

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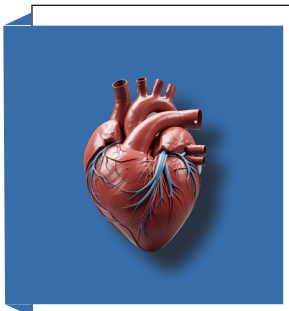

ROBOTİK DESTEKLİ KORONER BAYPASS AMELİYATLARI

BÖLÜM
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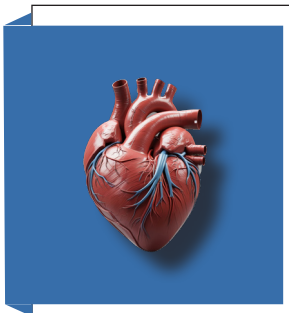

MİNİMAL İNVAZİV KAPAK CERRAHİSİ

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40

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insidansı açısından herhangi bir fark bulunamamıştır. Benzer şekilde Rival ve ark.(67), bir sistematik incelemede endoaortik balon kateter ve eksternal transtorasik aort klempleme arasında sağkalım ve inme insidansı açısından anlamlı bir fark olmadığını raporlamıştır. Murzi ve ark'nın (68) 2017 yılında yayınladığı ve 1632 MİMKC vakasını içeren gözlemsel araştırmada retrograd perfüzyon(femoral kanülasyon) ve antegrad perfüzyon(asendan aortadan kanülasyon) karşılaştırılmış ve retrograd perfüzyon uygulanan hastalarda inme görülme sıklığı daha fazla bulunmuştur. Modi ve Chitwood bir meta analizde, ameliyat öncesi dönemde tetkik edilmiş ve ciddi aortik ve periferik ateroskleroz görülmeyen olgularda retrograd perfüzyonun inme riskini artırmadığını belirtmişlerdir(69)

Olası komplikasyonlar:

- **Retrograd KPB perfüzyon** tekniğine bağlı olarak ateroembolik inme, vena kava yaralanması, femoral arter komplikasyonları, retrograd aort diseksiyonu sayılabilir. Bu tür komplikasyonların önüne geçmek adına tüm kanüller, TEE eşliğinde ve Seldinger tekniği ile yerleştirilmelidir. Endoaortik balon yaygın aortik ateroskleroz ya da hareketli aterom plağı varlığında kullanılmamalıdır.
- **Alt ekstremite iskemisi**, femoral arter kanülasyonuna bağlı görülebilir. Takibi için ilgili ekstremite distaline oksijen saturasyonu probu takılabilir. Belirgin bir düşme gözlenirse distal femoral artere kanül üzerinden bir şant uygulanabilir.
- **Frenik sinir yaralanması,** perikardın fazla asılmasına bağlı, kotere bağlı termal hasar, kriyoablasyon ya da direkt yaralanma şeklinde gerçekleşebilir.
- **Tek taraflı akciğer ödemi,** ciddi bir komplikasyondur. Kısa KPB, sistemik soğuma, barotravmadan kaçınma, kan ürünü replasmanının olabildiğince sınırlandırılması, mekanik ventilatörden ayırıp tekrar bağlama döngüsünün daha az sıklıkta tekrarlanması ile önüne geçilebilir. KPB esnasında düşük basınç ve frekansta havalandırma uygulanması faydalı olabilir (70,71)
- **Transtorasik eksternal aortik klemp** yerleştirme esnasında sağ pulmoner arter, sol ana koroner arter ve sol atriyum appendiksinde yaralanma görülebilir. Dikkatli bir diseksiyon ve görüntüleme ile önüne geçmek mümkündür.
- **Sağ ventrikül disfonksiyonu,** sol lateral 30° pozisyonu kros klemp kaldırılması esnasında pozisyonu itibariyle sağ koroner artere hava embolisi riskini artırmaktadır. Titiz bir hava çıkarma işlemi ile risk azaltılabilir.

Küçük kesiden yapılan prosedürlerin sayısı ve çeşidi tüm cerrahi disiplinlerde son çeyrek yüzyılda oldukça artmıştır. Son yıllarda hastaların artan kozmetik kaygılarının yanında, hızın iyiden iyiye arttığı dünyamızda, hastalıktan ya da ameliyattan sonra normal rutine olabildiğince çabuk dönme isteği, cerrahi alanındaki bu gelişmeleri kamçılamaktadır. Laparoskopik batın operasyonları, vajinal histerektomi, eklemp artroskopisi, sublingual tiroidektomi, video destekli toraks cerrahisi gibi minimal invaziv kapak cerrahisi de bu talebe karşılık vermek adına hızlı bir gelişim göstermektedir. Sağlık ve biyoteknoloji alanındaki gelişmelere her gün bir yenisinin eklendiği çağımızda, halihazırda yüksek hacimli merkezlerde rutin uygulamalar arasında yerini almayı başarmış minimal invaziv kalp cerrahisi, çok yakın bir dönemde orta-küçük ölçekli kliniklerde de kolay erişilebilir ve uygulanabilir hale gelecektir.

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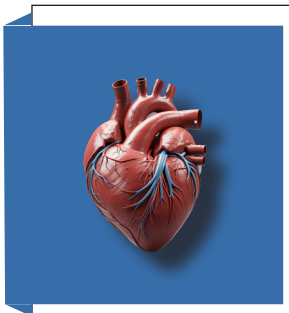

ROBOTİK KAPAK CERRAHİSİ

BÖLÜM
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Cerrah, kapak patolojisine veya başka bir şeye bağlı olarak, minimal erişimli bir yaklaşımın kaliteli bir sonucu kolaylaştıracağını düşünmüyorsa, o zaman sternotomi yoluyla ameliyata devam etmelidir. İşlemin birincil hedefi, hastanın kapak patolojisinin güvenli, başarılı ve tamamen düzeltilmesidir. Çoğu durumda bunun robotik destekli yöntemler kullanılarak gerçekleştirilebilse dahi, yalnızca robotik teknikleri kullanabilmek uğruna amaçlanan kapak operasyonunun bütünlüğünü ve dayanıklılığını tehlikeye atmanın kabul edilebilir değildir (4,5,14).

Mitral cerrahisi gerektiren bir hastanın, perkütan müdahaleye uygun olduğu düşünülen izole koroner hastalığı olduğu tespit edilirse, bazı durumlarda bu lezyonu stentlemek mantıksız olmayabilir ve bunu 4 ila 6 hafta sonra bir robotik mitral kapak prosedürü takip edebilir ve bu da bir "hibrit strateji" oluşturur. Bypass greftlemesi gerektiren daha yaygın koroner hastalık, robotik destekli bir operasyonu engeller ve sternotomi gerektirebilir (3–5,14,46).

Gelecek senaryoları / Sonuç

Teknolojinin gelişme hızına paralel olarak robotik kalp cerrahisi sistemleri de yüksek potansiyele sahiptir. Keskinliğin ve hassasiyetin artırılması, çok yönlülük ve diğer teknoloji modalitelerinin entegrasyonu halihazırda çalışılan konulardır. Örneğin, ekokardiyografinin entegrasyonu sayesinde daha iyi bir cerrahi bir planlama yapılarak etkinliği yüksek bir prosedür uygulanabilir. Gerçek zamanlı navigasyon sistemleri, yapay zeka ile geliştirilen intraoperatif karar destekleyici ekipman seçimi gibi konulardaki çalışmalar robotik cerrahinin geleceğini çizmektedir. Özellikle makine öğrenmesi destekli sistemler vasıtası ile her vakadan edinilen tecrübeler analiz edilip objektif şekilde ileriye aktarılabilecektir (41).

Ayrıca daha yüksek çözünürlüklü optikler, daha ince motor kontrolü ve koordinasyona olanak tanıyan daha düşük profilli daha küçük aletler ve robotik kollara bir tür "dokunsal" veya dokunsal geri bildirim sisteminin dahil edilmesi hepsi bir araya gelerek daha hızlı, daha pürüzsüz operasyonları kolaylaştıracak ve tutarlı bir şekilde tekrarlanabilir.

Bugüne kadar, konsolda ameliyat eden cerrah her zaman hasta ve başucu asistanıyla aynı ameliyathanede fiziksel olarak birlikte konumlandırılmıştır, ancak robotik teknolojiyi kullanan uzaktan tele-cerrahi potansiyeli uzun zamandır tahmin edilmektedir. Bu gelişmelerin bir kısmının veya tamamının ne kadar hızlı gerçekleştiği ve bunların transkateter kapak tedavilerinin patlayıcı şekilde büyüdüğü mevcut çağda oynayacakları rol hala görülecektir.

Minimal invaziv ve robotik destekli kalp cerrahisinin geleceğinin çok parlak olmaya devam etmektedir. Bununla birlikte, daha az invaziv tedavi isteği, cerrahın birincil hedefi olan hastanın patolojisini her zaman güvenli, eksiksiz, başarılı, ideal ve kalıcı bir şekilde düzeltmekten daha önemli olmamalıdır (4,7,16,41).

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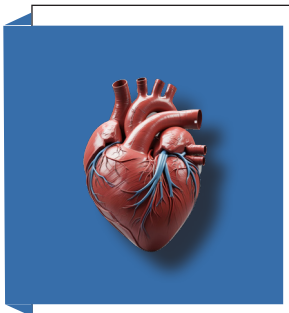

MİNİMAL İNVAZİV KONJENİTAL KALP CERRAHİSİ

BÖLÜM
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Adem REYHANCAN [3]
Elif GÜNEYSU [4]
Burak ERSOY [5]
Abdülkerim BUĞRA [6]
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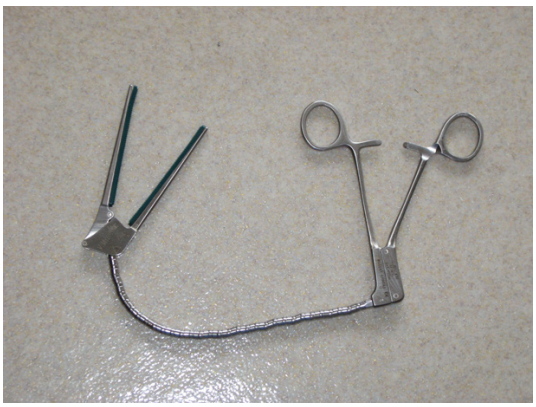
moner arteriyotomi sahasına yaklaşırken ideal minimal insizyonlar; üst parsiyel sternotomiler, sol parasternal ve sol anterior torakotomidir.(7)



Şekil 6. *Fleksibl kros klemp (Cosgroove klemp)*

Üst parsiyel sternotomi ile asendan aort ve sağ atriyal kanülasyon uygulanarak pulmoner arteriyotomi sahasında yeterli ekspojur sağlanabilir ve pulmoner kapak tamiri uygulanabilir.(8) Bununla birlikte sol anterior torakotomi ile subarteriyel ve perimembranöz VSD'ler tamir edilebilir. Lin ve ark. bu tip VSD'leri sol anterior mini torakotomi tekniği ile sol femoral arter ve ven kanülasyonuyla kros klemp uygulamadan, hipotermik fibrilatuar arrestte koroner perfüzyon devam edecek şekilde miyokardiyal koruma sağlayarak tamir etmişlerdir.(7)

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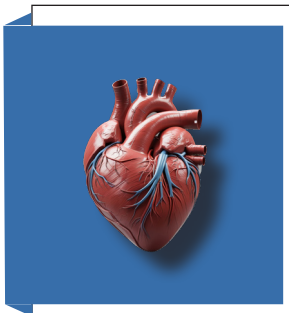

MİNİMAL İNVAZİV ATRİYAL FİBRİLASYON CERRAHİSİ

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43

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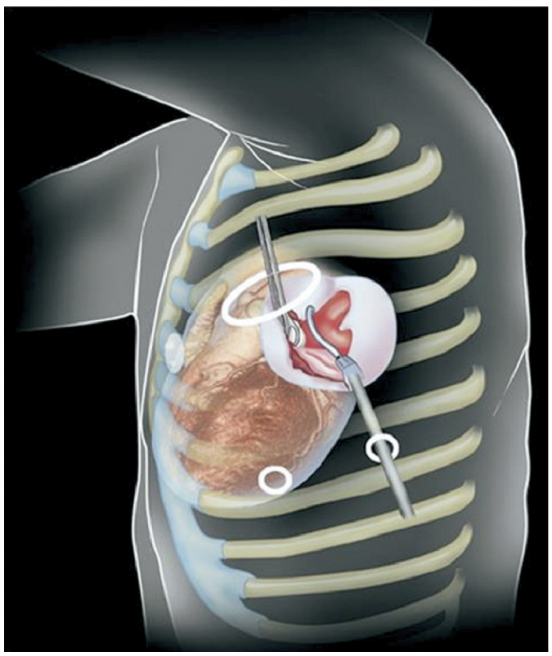
tan kalbin herniasyonunu önlemek için perikard kapatılmalıdır. Perikard kapatılmadan önce geçici pace leadleri sol ventrikül perikardının altına yerleştirilir. Bu işlem için sütürasyon gerekmez. Perikard askı dikişleri gevşetilir. Bu askı sütürleri ve ilave atılan sütürlerle perikard kapatılır. Eğer hasta işlem sonunda sinüs ritminde değilse; supin pozisyonunda yatırılıp kardiyoversiyon yapılır. Ekstübasyon genelde ameliyathanede gerçekleştirilir.



Şekil 5. *Sol torakstan yaklaşım (Randall K.Wolf. Minimally invasive surgical treatment of atrial fibrillation. Semin thorac cardiovasc surg 19:311.e1-311. e9.2007'dan alınmıştır.) (16)*

Postoperatif Dönem

Antiaritmik ve antikoagülan tedaviyi sonlandırmak için çeşitli stratejiler vardır. En az 3 ay antikoagülan tedavi verilir ve preoperatif antiaritmik ilaçlara devam edilir. İlk 6 ay ritm açısından risklidir. Artmış katekolamin ve ödeme bağlı AF atakları görülebilir. Bu nedenle refraktör süreyi uzatan antiaritmik ilaçlar (amiodaron) önerilmektedir. Semptomatik AF'si varsa ilk 48 saat içinde kardiyoversiyon yapılır. Postoperatif AF değerlendirmesi için ritm holter monitörizasyon kullanılabilir.

SONUÇ

Yeni gelişen teknoloji ile birlikte AF'nin cerrahi tedavisi hızlı ve basit hale gelmiştir. Açıkçası epikardiyal olarak atan bir kalp üzerinde yapılan atriyal ablasyon, katater ile yapılan endokardiyal yaklaşımdan daha avantajlıdır. Geniş hasta grupları üzerinde, başarılı sonuçları, düşük mortalite ve morbidite oranları ile yapılacak olan minimal invaziv ablasyon konusunda deneyim kazanılması kalp cerrahisi açısından son derece önemlidir. Bu işlem için en ideal yaklaşım; sol atriyumun arka tarafını göstermeli, tam kat lezyon yapmalı, elektriksel yalıtım sağlamalı, elektriksel izolasyonu test edebilme imkanı vermeli ve tüm bunları çevre dokulara zarar vermeden yapmalıdır.

Endoskopik minimal invaziv tekniklerdeki gelişmelere rağmen; robot teknolojisinin AF'nin cerrahi tedavisinde kullanıma girmesi ile birlikte; AF'li hastalarda perkutan tekniklere önemli bir alternatif ortaya çıkmıştır. Bipolar ve minimal invaziv tekniklere uygun ablasyon kalemlerinin gelişmesine paralel olarak minimal invaziv AF cerrahisi ile perkutan AF tedavisi rekabeti iyice artacaktır. Ancak kombine girişimlere olanak tanıması dolayısıyla minimal invaziv cerrahi ile ablasyon her zaman bir adım önde olacak gibi gözükmektedir. Birçok merkez bu iki yöntemi hibrid bir şekilde uygulasa da; geleceğin hangisi için yeni ufuklar açacağını; etkinlik, güvenlik ve maliyetleri belirleyecektir.

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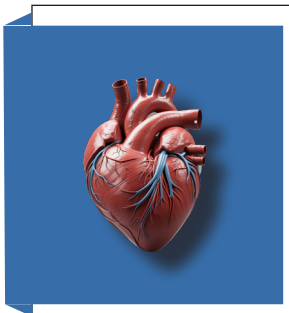

MİNİMAL İNVAZİV PERİKARDİYAL VE MEDİASTİNAL HASTALIK CERRAHİSİ

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44

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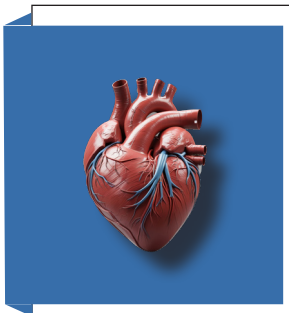

TORAKOSKOPİK CERRAHİ

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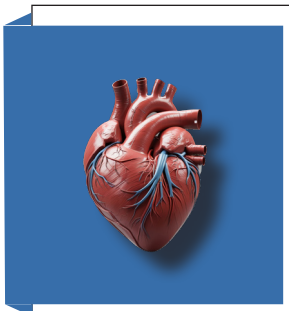

ÇALIŞAN KALPTE KORONER CERRAHİSİ

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şeklinde sıralanmıştır ve bizim 6. Ulusal Kalp ve Damar Cerrahisi kongresinde bildirdiğimiz düşüncelerle örtüşmektedir (34). Yine erken dönemlerde adaptayon sürecinin güvenli ve hızlı olması için uygun hasta seçimi, anastomoz yapılacak damar ve greft seçimi önemlidir. Başlangıç döneminde on pump çalışan kalp, sonrası kanüle ancak çalışan kalp, dolu daha sonra ise kuru pompa bekletilerek yapılan sıralama ile nihai tam olarak çalışan kalbe geçiş sağlanabilir (224).

ÇKKC uygulamalarının erken ve geç sonuçlarına ilişkin en güçlü bilimsel kanıtlar ortaya konsa bile her kurum ve cerrah bireysel sorumluğunun farkında olmalıdır. Etik değer ve kurallardan uzaklaşmadan, yeni tedavi yöntemlerinden vatandaşların zarar görmeksizin yarar sağlayabilmesine olanak sağlamak gerek sağlık ve eğitim kurumlarının gerekse meslek odaları ve ulusal mesleki derneklerin sorumlulukları arasındadır. ÇKKC uygulamalarının hedeflenen yararlarına ulaşılabilmesi için, meslek derneklerinin eğitim kurumlarıyla iş birliği içerisinde formal eğitim proğramları hazırlaması ve güncelleyerek tekrarlaması gereklidir.

Son yıllarda mekanik stabilizasyon kullanılarak yapılan ÇKKC uygulamalarının erken ve orta dönem sonuçları konvansiyonel yönteme benzer ve bazı alt gruplarda daha iyi niteliktedir. Önemli avantajları arasında özellikle yüksek risk gruplarında morbidite ve mortalitenin azalması, daha kısa yoğun bakım süresi, daha erken taburculuk, daha seyrek transfüzyon ve maliyet azalması sayılabilir.

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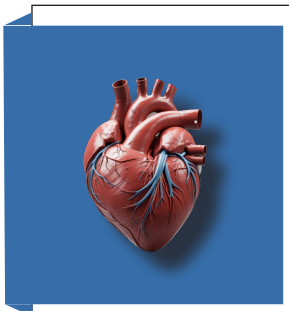

KOMBİNE KORONER, KAROTİS VE PERİFERİK GİRİŞİMLER

BÖLÜM
47

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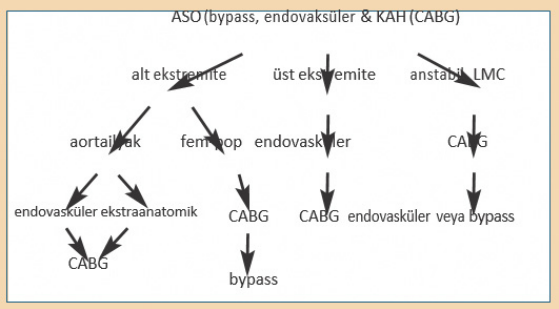
arttırden periferik arteriyel hastalıktan şüphe edilen olgularda ABI'in önemi vurgulanmaktadır.

Genellikle genel anestezi gerektirmeyen, femoral arter ve distalinde lezyonları bulunan hastaların tedavisinde, koroner arter hastalığı açısından stabil- seler düşük risk ile cerrahi uygulanabilir. Bu olgular- da hemodinamik monitörizasyon önem kazanır. İnvaziv arteriyel monitörizasyonun yanısıra swan ganz kateterizasyonu intraoperatif miyokard enfark- tüsünün tanınabilmesi amacıyla bazı merkezler tarafından sıklıkla kullanılmaktadır.

Subklaviyan düzeydeki arteriyel patolojilerin koroner bypass öncesinde hemodinamik monitörizasyonu etkileme riski dışında özel bir önemi mevcuttur. Bu da 10 yıllık patensi %90'ın üzerinde olan ve özellikle sol anterior desending (LAD) arterin revaskülarizasyonu için kullanıldığında sağkalımı olumlu etkileyen internal torasik arterin kullanılabil- mesi için subklaviyen arterin normal olmasıdır. Subklaviyen darlığı bulunan olgular basit bir sağ-sol kol tansiyon arteriyel karşılaştırmasıyla yakalanabilir. Sağ-sol kol tansiyon farkı olan olgularda dubleks USG ile değerlendirme gereklidir. Günümüzde subklaviyen steal sendromu gibi üst ekstremiteyi ilgilendiren arteriyel patolojilerde endovasküler tedavi ile oldukça başarılı sonuçlar elde edilmektedir(52) (Şekil 4).

KORONER VE AORTO BİİLYAK GİRİŞİMLER

İlyak seviye ve üstünde yeralan lezyonlarda operatif risk distal girişimlere oranla daha yüksektir. Bu olgular genellikle genel anestezi gerektiren batın veya retroperitoneal yaklaşımlara ihtiyaç duyarlar. Kanama ve hemodinamik instabilite riskleri daha yüksektir. Aortanın klempajı ile yükselen afterload ve deklempaj ile oluşan ani hipotansiyon ve metabolik asidoz, düzeltilmemiş koroner arter hastalığı bulunan olguları olumsuz etkiler. Bu nedenlerle bu olgularda koroner arter cerrahisinin veya kardiyolojik girşimlerin daha önce uygulanması gerekmektedir. Koroner açıdan stabil ancak ekstremitede istirahat ağrısı veya iskemisi bulunan olgularda batın eksplorasyonuna gerek kalmadan uygulanan femoro- femoral veya aksillobifemoral bypass gibi ekstraanatomik yaklaşımlar uzun dönem patensileri çok iyi olmamakla birlikte daha düşük morbidite ve mortalitesiyle bir seçenek olarak görünmektedir. Ancak bu konudaki en önemli gelişme ilyak pozisyonda endovasküler girişimlerin başarısının giderek artmasıdır. Stent teknolojisindeki gelişmeler ve düşük morbidite ve mortalite, koroner bypass öncesinde de bu lezyonların tedavisini olanaklı kılmaktadır.



Şekil 4. *Periferik arter hastalığının eşlik ettiği koroner arter hastalıklı olgularda tedavi stratejisi.*

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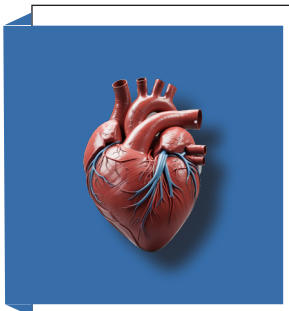

ROBOTİK KALP CERRAHİSİ

BÖLÜM
48

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nesil sistemlerdeki doku tanıma algoritmaları ve otomatik anastomoz cihazları cerrahi süreçleri daha da optimize edecektir. Ayrıca uzaktan cerrahi uygulamalarının gelişmesi, kırsal bölgelerdeki hastaların da uzman cerrahlara erişimini kolaylaştıracaktır.

Sonuç olarak, robotik kalp cerrahisi teknoloji ile tıbbın sinerjisini en iyi şekilde yansıtabilecek bir disiplindir. Hem cerrahların teknik kapasitesini artıran hem de hasta konforunu ön planda tutan bu yaklaşım, kardiyovasküler hastalıkların tedavisinde yeni bir çağın kapılarını aralamaktadır. Ancak, maliyet etkin çözümler, eğitim programlarının standardizasyonu ve multidisipliner iş birlikleriyle bu teknolojinin daha geniş kitlelere ulaşması sağlanmalıdır. Ülkemizde robotik cerrahi alanında açılacak yeni merkezler ve cerrahlarımızın kazandığı uluslararası tecrübe, Türkiye'yi bu alanda dünyanın öncü ülkelerinden biri haline getirmeyi hedeflemektedir. Bu hedef, hem vatandaşlarımızın sağlık hizmetlerinin kalitesini en üst düzeye çıkararak milletimizin refahını artıracak hem de yurtdışından gelecek hastalarla ülkemizin ekonomisine önemli bir katkı sağlayacaktır. Türk tıbbı, bu vizyon ile gelecekte de milletimizin gurur kaynağı olmaya devam edecektir.

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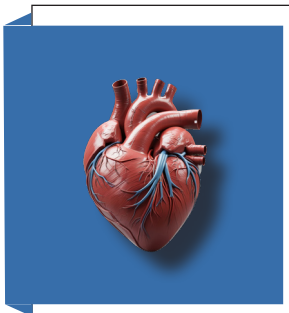

ANASTOMOZ CİHAZLARI

BÖLÜM
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Haluk Çağlar KARAKAYA [1]

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dır. Cihaz, titanyumdan üretilmiş küçük kancalara sahip bir halka yapısına sahiptir ve greft ile hedef damarın intima yüzeylerini karşılıklı olarak sabitleyerek sütür gereksinimini ortadan kaldırır. HeartFlo®'nun amacı, distal anastomoz süresini azaltmak ve teknik zorlukları minimize ederek standart, tekrarlanabilir sonuçlar elde etmekti. Ancak, cihazın klinik uygulamalarında teknik yerleşim zorlukları, greft ve hedef damar arasında tam uyum sağlanamaması ve erken dönem tromboz/stenoz gibi komplikasyonların görülmesi nedeniyle uzun dönem sonuçlar beklentileri karşılamamıştır. Ayrıca, cihazın sınırlı endikasyonlara sahip olması ve maliyet etkinliğinin düşük bulunması, ticari başarısızlığa yol açmış ve bu nedenle HeartFlo piyasadan çekilmiştir.

Diğer Cihazlar

ATG Coronary Connector®, Solem Graft Connector® ve Magnetic Vascular Positioner® gibi birçok farklı cihaz geliştirilmiş olmasına rağmen, bu cihazların bazıları deneysel aşamada kalmış, bazıları ise yüksek cihaz kompleksitesi ve/veya komplikasyon oranları veya maliyet etkin olmamaları sebebiyle piyasadan çekilmiştir.

MANUEL DİSTAL ANASTOMOZ CİHAZLARI

U-Clip® (Medtronic, Inc., Minneapolis, MN, ABD)

U-Clip®, kardiyovasküler ve genel cerrahi uygulamalarında kullanılan, düğümsüz sütürleme sağlayan bir sistemdir. Elastik hafızalı nitinol veya titanyumdan üretilen U şeklindeki klipsler, cerrahi iğne ile dokuya geçirildikten sonra kendiliğinden kapanarak sütür hattını sabitler. Özellikle küçük çaplı damar anastomozları ve minimal invaziv cerrahilerde işlem süresini kısaltan ve teknik kolaylık sağlayan bu sistem, geleneksel sütür yöntemine benzer şekilde manuel olarak uygulanır. Ancak U-Clip, düğüm atma ihtiyacını ortadan kaldırarak cerrahi süreyi azaltır ve günümüzde sınırlı da olsa halen aktif klinik kullanımda bulunmaktadır.

Diğer Cihazlar

VCS Autosuture® gibi manuel cihazlar dizayn edilse de, klinik pratikte kullanım yeri bulamamıştır.

SONUÇ

Günümüzde mekanik anastomoz cihazları, cerrahi işlemlerde daha hızlı ve güvenilir anastomozlar oluşturulmasına olanak sağlamaktadır. Cihaz destekli anastomozlar, cerrahın el becerisine bağlı değişkenliği azaltarak daha standart ve tekrarlanabilir sonuçlar hedeflenmiştir. Ayrıca cerrahi sürelerin kısalması, kanama miktarının azalması ve kalp-akciğer pompası ve kros klemp sürelerinin kısalması gibi operasyonel avantajlar elde edilmiştir. Bütün bu gelişmeler, hastanede kalış sürelerinin kısalması, erken mobilizasyon ve daha hızlı iyileşme gibi hasta odaklı sonuçlara da olumlu yansımıştır. Cihaz kullanımına bağlı maliyet artışı, eğitim gereksinimi ve bazı teknik sınırlamalar gibi faktörler ise halen tartışılmaktadır. Sonuç olarak, anastomoz tekniklerinin tarihsel gelişimi, cerrahi beceri temelli manuel yöntemlerden teknoloji destekli, standartlaştırılmış mekanik cihazlara doğru evrilme göstermektedir. Bu süreç, kardiyovasküler cerrahinin daha güvenilir, hızlı ve hasta dostu bir hale gelmesine katkı sağlamayı amaçlamıştır. Günümüzdeki eğilim, cerrahi sürecin her aşamasını optimize eden, komplikasyonları en aza indiren ve uzun dönem açıklık oranlarını artıran yeni nesil anastomoz cihazlarının geliştirilmesi yönündedir.

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